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GOOD ROADS YEAR BOOK

OF THE

UNITED STATES

AMERICAN HIGHWAY ASSOCIATION

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WASHINGTON, D. C.

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GOOD ROADS YEAR BOOK

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GENERAL REVIEW OF PROGRESS IN ROAD IMPROVEMENT DURING 1914

Mileage. In the construction of hard surfaced roads, it is estimated that 18,000 miles were completed during 1914 as compared with a total of 16,000 miles completed in 1913. This is an excellent showing in view of the fact that constructive work in most lines of private enterprise was considerably curtailed during the same period. In round figures, the roads of the United States now aggregate 2,300,000 miles in length, of which approximately 10 per cent are classed as improved roads. As indicating State activity in road construction, it may be stated that at the close of 1913, about 25,500 miles had been completed with the aid of State funds, and it is estimated that during 1914 about 6000 miles of additional State roads were completed, thus making a total to January 1, 1915, of about 31,500 miles.

Expenditures. The outlay by States, counties, townships and districts for road purposes during 1914 reached a grand total of nearly $225,000,000, including the estimated value of statute labor, according to the best estimates available. This expenditure, compared to a total outlay in 1904 of approximately $79,000,000, shows a remarkable development in the road movement during the past ten years. A sum approximating $200,000,000 has been expended by the various State governments from State revenues to January 1, 1915, and of this amount approximately $43,000,000 was expended during the year 1914.

State Aid. Kentucky, during the past year, provided State aid for road improvement by a levy of a one-half mill tax, which will yield for expenditure in 1915 about $600,000.

Colorado, at the general election in 1914, approved a measure providing for a one-half mill tax in aid of road improvement. From this levy the State will derive about $500,000 per annum.

Illinois entered actively upon State road work in 1914 under an appropriation of $700,000 for 1914–1915, this amount to be supplemented by an equal amount from the various counties. An appropriation of $100,000 per annum is made for engineers and for experimental work.

Maryland provided for an additional State bond issue of $5,000,000 to apply to the construction of a State road system of approximately 1300 miles.

Mississippi enacted legislation to require the employment of engineers to supervise the construction of all roads financed by county bond issues.

At the November election the people of North Dakota ratified a constitutional amendment to enable the State to grant aid in the construction of highways. This amendment will not be practically operative until legislation is enacted by the State legislature.

Federal Aid. The final report of the Joint Congressional Committee on Federal Aid in the Construction of Post Roads was issued on January 21, 1915. The committee was composed of Jonathan Bourne, Jr., chairman, Senators Penrose of Pennsylvania, Gronna of North Dakota, Swanson of Virginia, Overman of North Carolina, and Representatives Shackelford of Missouri, Lee of Georgia, McGillicuddy of Maine, Madden of Illinois, and Austin of Tennessee. The report embodies data from foreign countries showing the systems in effect, the mileage and cost of roads constructed, etc.; similar data from the several States; extracts from State constitutions showing limitations of State debt; statistics on tonnage transported over rural roads; statistics on length, character and condition of rural routes; transportation rates on road materials by rail; comparative statistics embodying possible factors in apportionment of Federal aid; statistics of wealth, debt, highway expenditures, etc.; comparative statistics on the cost of road construction; a short sketch of the Old Cumberland Road; work of the Office of Public Roads of the U. S. Department of Agriculture; synopsis of congressional action on Federal aid to road improvement. The report dwells upon the economic importance of good roads, the constitutionality of Federal aid, the practical reasons why Federal aid should be granted, and gives data to prove an overwhelming public sentiment in its favor. In reply to inquiries sent out by the committee to ascertain whether or not the people desired Federal aid in the improvement of public roads, replies were received from every State in the Union, representing 100,000 individuals. Of these replies 97 per cent favored Federal aid and 3 per cent opposed it.

As indicating the attitude of our national legislators toward the subject of Federal aid to roads, it may be stated that ten bills were introduced in the Senate during the 63d Congress and 39 bills in the House of Representatives, providing for such Federal aid. This action was taken by Senators Jackson of Kansas, Thornton of Louisiana, Smith of Georgia, Overman of North Carolina, Gore of Oklahoma, Lea of Tennessee, Poindexter of Washington, Swanson of Virginia, Bankhead of Alabama, and Bryan of Florida, and by Representatives Flood of Virginia, Hobson of Alabama, Madden of Illinois, Austin of Tennessee, Burnett of Alabama, Oldfield of Arkansas, Anthony of Kansas, Campbell of Kansas, Sims of Tennessee, Bell of Georgia, Dent of Alabama, Rubey of Missouri, Hensley of Missouri, Byrnes of South Carolina, Ferris of Oklahoma, Adamson of Georgia, Whitacre of Ohio, Shackelford of Missouri, Keating of Colorado, Stephens of Mississippi, Lea of Georgia, Candler of Mississippi, Tribble of Georgia, Hayden of Arizona, Byrns of Tennessee, Woodruff of Michigan, Saunders of Virginia, Moss of West Virginia, Edwards of Georgia, Barkley of Kentucky, Moon of Tennessee, Cox of Indiana, Falconer of Tennessee, and Neeley of West Virginia.

On February 10, 1914, a bill introduced by Representative Shackelford of Missouri, providing for an appropriation of $25,000,000 to be expended by the secretary of agriculture in coöperation with the States and their civil sub-divisions, passed the House of Representatives. The bill was referred to the Committee on Post Offices and Post Roads of the Senate, which reported a substitute for the House bill. This substitute embodied a plan, generally known as the "Bourne Plan," and provided that the Federal government should issue three per cent bonds and lend the money to the States, they to pay 4 per cent, of which 1 per cent would be applied to a sinking fund to retire the State bonds in approximately 50 years and the 3 per cent to meet the interest obligations on the corresponding issue of Federal bonds.

A bill introduced December 3, 1913, by Senator Gore of Oklahoma, providing for coöperation between the Department of Agriculture and State highway departments, and carrying direct appropriation on a sliding scale, was referred to the Committee on Agriculture and Forestry and was reported by the Committee on March 24, 1914, with an amendment making the amounts appropriated $5,000,000 for the fiscal year ending June 30, 1916, and increasing this amount for each subsequent fiscal year until the amount should reach $10,000,000 for the fiscal year ending June 30, 1921.

The foregoing record of congressional activity indicates clearly a preponderating sentiment for Federal aid in the present Congress, and only the abnormal conditions brought about by the European war are sufficient to delay definite action.

Road Conventions and Congresses. The American Road Congress, under the auspices of the American Highway Association and the American Automobile Association, held its sessions at Atlanta, Georgia, during the week of November 9, 1914. Forty-seven organizations took part in the Congress, and the actual attendance of delegates and visitors was upwards of 5000 although the actual registration during the first four days was 3306. After the first day local attendance was not registered and there were many visitors who attended the meetings without going through the formality of registration. State highway commissioners or engineers of New Hampshire, Massachusetts, Connecticut, Rhode Island, Maryland, Virginia, West Virginia, North Carolina, Alabama, Kentucky, Arkansas, Louisiana, Oklahoma, Kansas, Illinois, Michigan, Minnesota, Utah, Washington, and California, were present in person. New York was represented by General W. T. Rossell, consulting engineer, and the State of Pennsylvania was represented by the first deputy commissioner, Joseph W. Hunter. The New York Highway Department exhibited a remarkable model showing the construction of the State highway across the face of Storm King Mountain on the Hudson River.

A remarkably complete series of exhibits, participated in by the U. S. government, a number of the State governments and 100 manufacturers, constituted the largest display illustrative of public road work ever shown in this country.

The annual convention of the American Road Builders' Association was held at Chicago during the week of December 18, and was one of the most successful meetings ever held by that organization. The attendance is announced to have been in the neighborhood of 3000 and the exhibits participated in by the Federal government, State governments and a large number of manufacturers were highly successful. This convention, and that held at Atlanta and known as the American Road Congress, comprise the two great annual meetings in the interest of road improvement.

HISTORY OF ROAD BUILDING

Ancient Road Builders

When or where the first road was built is not known. Herodotus speaks of a great Egyptian road on which King Cheops employed 100,000 men for a period of ten years. According to the historian, this road was built of massive stone blocks 10 feet deep, and lined on both sides with temples, mausoleums, porticoes and statues. The streets of Babylon are said to have been paved as early as 2000 B.C., and several well surfaced roads radiated to neighboring cities. Carthage, before its fall, was the center of a highly developed road system. The ancient Peruvians had a wonderful system of national roads connecting all the principal parts of their empire.

Bridges were also built by the ancients at a very early date. The Euphrates, at Babylon, was crossed by a stone bridge prior to 2000 B.C., and it is known that the Chinese built bridges as public works as early as 2900 B.C.

The Romans as Road Builders

The first definite and fully authentic information concerning the systematic construction and maintenance of permanent roads comes to us from the Romans. It is generally understood that the Romans learned the art of road building from the Carthagenians. However, the construction of their first great road was as perfect as that of any of their later ones.

The first of the great Roman roads was from Rome to Capua, a distance of 142 Italian miles, and was begun by Appius Claudius, about 312 B.C. It was known as the Appian Way or "Queen of Roads." This road was later extended to Brundisium, a total of 360 miles, and was probably completed by Julius Cæsar. About 220 B.C. the Flaminian Way was built. It crossed the river Nar on a stone bridge which had a central span of 150 feet with a rise of 100 feet. When Rome reached the height of her glory, under the reign of Augustus, no less than 29 great military roads radiated from the city. These roads extended to every part of the vast empire and are estimated to have had a total length of 50,000 miles.

The Roman construction was in general extremely massive. The Appian Way is said to have been in good repair 800 years after it was built. On a carefully prepared earth subgrade was placed four successive courses or layers; the statumen or foundation course, the rudus or second course, the nucleus or third course, and the pavimentum or wearing surface. The top and bottom courses consisted in general of large flat stones, while the two intervening courses were built of smaller stone or other suitable material laid in lime mortar.

With the fall of the Roman Empire the roads were neglected and gradually fell into decay, so that today but little more than a trace remains of these splendid achievements.

The French as Road Builders

The Romans built and improved many roads throughout what is now France, but later these fell into decay. It was not until the beginning of the seventeenth century that interest in road building revived to any considerable extent. In 1661 Colbert was appointed comptroller of finance, and during his ministry 15,000 miles of hard road were built by means of enforced peasant labor under the old feudal institution of the corvee. The corvee prevailed with the utmost rigor until 1774, when Turgot abolished some of its most objectionable features. It was finally abolished in 1787.

The present road system of France was really founded by Napoleon. He adopted very largely the innovations instituted by Tresaguet, and perfected a splendid administrative system.

The most striking feature of the French road system is the skilled supervision provided in every grade of road work and in every unit of the administrative organization. The basis of the French system is the School of Roads and Bridges, one of the finest technical schools in the world, and maintained entirely at the expense of the National government. From the graduates of this school are chosen the highway engineers who are entrusted with the construction and maintenance of the roads of France.

The total mileage of all roads in France is about 355,000 miles. Of these 23,820 miles are classed as national roads and are, therefore, the property of the State. The remaining roads are divided into departmental and vincinal routes, for which the state only makes occasional appropriations for construction and which are invariably maintained by the local governments.

Toll Roads

The earliest mention we have of the exaction of tolls is probably that given by Strabo, on the roads leading from Babylon to Syria. It is not until 1346 that we find the toll system definitely adopted as a means of raising revenue for road maintenance and repair. In that year Edward III of England granted a commission to the Master of the Hospital of St. Giles and John Holborn to collect tolls on vehicles passing on the road leading from the Hospital of St. Giles to the Old Temple, London, and also on an adjoining road called the Portal. But it was not until the latter half of the eighteenth century and first part of the nineteenth century that this method of raising road revenues reached its greatest popularity. This took the form of a regular flood of turnpike acts passed by Parliament. It is estimated that in 1838 no less than 1100 turnpike trusts were in existence throughout the kingdom. The cost of collecting the tolls, however, often nearly equaled the income, leaving little or nothing for maintenance. In 1871 the census showed that 5000 persons in England and Scotland were engaged in merely collecting tolls. In 1857 Ireland freed herself from toll gates, and in 1878 Parliament passed an act abolishing tolls in England.

Tolls on vehicles were never popular in France and while introduced somewhat at different periods, never became general.

In the United States the first toll road was the Lancaster Pike, between Philadelphia and Lancaster, Pennsylvania, a distance of 62½ miles, the construction of which was authorized in 1792. Bridges were also constructed by private capital and tolls charged for crossing. The turnpike improvements continued to expand rapidly until in 1828 the length of chartered turnpikes in Pennsylvania amounted to 3110 miles, of which 2380 miles were completed at a cost of $8,431,059.50. It is stated that none of these roads had, up to that time, yielded sufficient dividends to remunerate their proprietors. By 1811 over 317 turnpikes had been chartered in New York and the New England States, having a combined length of 4500 miles and a capital of over $7,500 000. With the introduction of the railroad, interest in turnpike building practically ceased, and today there remain in the United States very few roads on which toll is collected on passing traffic.

The Cumberland Road.—Popular tradition generally attributes the conception of the National Road to Henry Clay. However, Albert Gallatin seems to have made the first definite suggestion of this road, while Henry Clay soon became its ablest champion.

By an act of Congress approved by President Jefferson on March 29, 1806, $30,000 was appropriated toward the survey and construction of a road leading from a point on the Potomac at or near Cumberland, Maryland, to the Ohio River at or near a point opposite the town of Steubenville. This act provided that the road be cleared to a width of four rods, and that no grade exceed five degrees. An act of Congress, May 15, 1820, provided $10,000 for laying out a road from Wheeling, Virginia, to the Mississippi

River near St. Louis. This was really to be a continuation of the Cumberland or National Road. The road was to be laid out 80 feet wide.

In 1835 arrangements were completed whereby the portion of the National Road between Cumberland and Wheeling was taken over by the respective States and operated as a toll road. Appropriations, however, were continued on the portion west of the Ohio River until May 25, 1838, when the last direct appropriation for construction was made. The total amount appropriated by Congress was $6,824,919.33.

The length of the line first opened was 130 miles and the cost of construction $1,700,000. The first stage coach bearing the United States mail from Cumberland to Wheeling passed over the road on August 1, 1818.

West of the Ohio, the road led through Columbus, Indianapolis and Terre Haute. The road was surfaced to Columbus, but west of that point it was only surfaced in places; and about 1850 most of the road was absorbed by local turnpike companies. Before the road was completed beyond the western boundary of the State of Indiana, the steam railway had become the chief agency of transportation and the National Road came to an end on the prairies of Illinois.

Great Road Builders

Tresaguet.—Pierre-Marie Tresaguet was born at Nevers, in 1716, died in Paris, 1796. While he was a great engineer and made many improvements for river navigation, posterity knows him only as a great road builder. Tresaguet may well be called the father of modern road building. In 1775, when MacAdam was but twenty-one years of age, Tresaguet presented a report to the Assembly of Bridges and Highways which amounted in reality to a treatise on road construction. The real value of Tresaguet's work was; first, in recognizing the need of constant maintenance and devising a means for carrying it out; second, improving the methods of construction and reducing the cost. The prevailing form of stone roads up to this time consisted of a transversely level stone pavement on which was placed broken stone to the depth of 12 inches at the sides and 18 inches at the middle. Tresaguet improved the drainage, gave a crown to the stone pavement or foundation, and reduced the depth of broken stone to a uniform thickness of 10 inches. The roads built by Tresaguet differ but little from those built by Telford in Scotland some thirty years later. While Tresaguet was not fortunate enough to leave his name to the type of road he advocated and built, he laid the foundation upon which it was possible for Napoleon to build the great system of French highways. Tresaguet laid especial emphasis on organized, continuous maintenance. He first began the organization of cantonniers, which are the very backbone of the present French system of road maintenance.

John Loudon MacAdam.—John Loudon MacAdam was born at Ayr, Scotland, September 21, 1756, and died November 26, 1836.

While MacAdam was not the inventor of the road which now bears his name, he nevertheless deserves great credit for the work he did. The broken stone road as adopted by MacAdam was used in practically the same form in several parts of Europe, though he was no doubt the first to grasp and fully explain the theory of the broken stone road without a paved foundation.

MacAdam demonstrated that stone when broken to the proper size and placed on a properly drained and graded earth foundation would so consolidate under traffic as to be thoroughly waterproof and capable of carrying the heaviest vehicles without injury. He held that the earth, in fact, sustained the load, and all that was necessary was to thoroughly drain the roadbed and protect the surface with an impervious covering.

At the death of his father in 1770, young MacAdam went to live with his uncle, a merchant in New York City. In 1783 he returned to Scotland and was shortly appointed as deputy-lieutenant for the county of Ayreshire. In performing his duties as magistrate and trustee of roads, MacAdam became impressed with the lack of scientific principles in the construction and maintenance of the roads. In 1816, he became inspector for the Bristol "Turnpike Trust" and supervised the reconstruction and repair of 178 miles of roads. In 1817 he built the first macadam roads in London, the approaches to Blackfriars and Westminster bridges. In 1823 MacAdam moved to London, where he was appointed street commissioner in 1817. Slowly the system of construction and maintenance which he advocated spread throughout the entire empire. In 1836 he returned to Scotland where he owned a house in the little town of Moffat: but he was not long permitted to enjoy his leisure, for he died the same year.

His principal writings are: *A Practical Essay on the Scientific Repair and Preservation of Public Roads*, London, 1819, and, *Remarks on Present State of Road Making*, London, 1820.

Thomas Telford.—Thomas Telford was born in Dumfriesshire, Scotland, August 9, 1757, and died September 2, 1834, and was buried in Westminster Abbey.

Thomas Telford was one of the greatest civil engineers of his time. He was one of the founders of the "Institution of Civil Engineer " and was annually elected as its president until his death. His works were recognized both at home and abroad. For the Austrian government, he built the road from Warsaw, to

Brest, while the King of Sweden conferred the order of knighthood of "Gustavus Vasa" in recognition of his services on the Gotha Canal. As some of his most notable achievements may be mentioned the following bridges: Across the Tay at Dunkeld, the Menai Straits, the Conway bridge, the Deanbridge at Edinburgh, and the Broomielaw bridge at Glasgow. Canals: Ellesmere, Caledonian, Gloucester and Berkeley, Grand Trunk, Macclesfield, Birmingham and Liverpool Junction, and the Gotha. Harbors: Pulteneytown, Aberdeen, Dundee, Dover, and the St. Katherine dock at London.

In 1803 he was appointed engineer for the construction of 920 miles of roads in the highlands of Scotland. Later, he perfected the road communication between London and Scotland and the northern towns of England. An undertaking of equal magnitude and importance with that in the highlands of Scotland was a system of roads through the more inaccessible parts of Wales.

The form of construction most generally used by Telford, and which bears his name, is very similar to that employed much earlier by Tresaguet. The foundation course on which is placed the broken stone consists of stones about 10 inches by 6 inches by 4 inches, in dimension, carefully placed by hand and keyed firmly with smaller chips. Care is taken to secure the best possible drainage. At the present time, the Telford system is more commonly employed abroad than in this country. American road builders usually only resort to the Telford system when the natural earth foundation is weak. The chief objection is generally stated as being the high first cost due to the large amount of hand labor required.

Principal Inventions

The Steam Road Roller.—The steam road roller was invented by M. Louis Lemoine, of Bordeaux, France, and a patent was granted to him by the French government in 1859. M. Lemoine's roller was first used on the road in the Bois de Boulogne in 1860. The first English patent was granted to Messrs. Clark and Batho in 1863. About 1864 a roller built under this patent was shipped to Calcutta, where it was used with great success.

The first steam roller used in England was on the roads in Hyde Park in 1866. In September 1867, the borough authorities of Liverpool purchased from Messrs. Aveling and Porter their first steam road roller, which weighed 30 tons.

The first steam roller used in the United States was imported from England in the fall of 1868. This roller was first used in the United States Arsenal grounds, Philadelphia, Pennsylvania. At the present time, the term "steam roller" is somewhat of a mismomer, as the recent developments in oil and gasoline engines have made this form of motive power practical.

The Stone Crusher.—The stone crusher was invented in 1858, by Mr. Eli Whitney Blake, of New Haven, Connecticut. Mr. Blake's crusher was used for the first time in Central Park in crushing stone for concrete. In 1859 the city of Hartford, Connecticut, purchased one of these crushers for use in the improvement of its streets and roads. This is the first application of mechanical power in the preparation of road metal.

Mr. Eli Whitney Blake was born in Westboro, Massachusetts, on the 17th of January, 1795. He was a nephew of Eli Whitney, the inventor of the cotton gin. In 1816 he graduated from Yale. For a time he studied law, but soon entered the manufacturing business. He died in 1886.

ROAD SYSTEMS OF FOREIGN COUNTRIES

Austria-Hungary

The roads in Austria-Hungary are divided into four administrative classes, namely; government roads, provincial roads (designated county roads in Hungary), district roads, and town roads (designated parish roads in Hungary). The government roads, of which there are 10,008 miles in Austria and 5600 in Hungary, are constructed and maintained at the expense of the imperial government, which has complete supervision over construction and maintenance. The provincial roads in Austria, of which there are 2288 miles, and county roads in Hungary, of which there are 17,400 miles, are constructed and maintained at the expense of the province or county, the imperial government contributing in some cases. The district roads, of which there are 39,212 miles in Austria and 8100 miles in Hungary, are constructed and maintained by the districts, except that very poor districts are aided by the province or the county. The town roads, of which there are 22,756 miles in Austria, and the parish roads, of which there are 700 miles in Hungary, are local roads and are paid for by the town or parish, the province or county occasionally aiding by grants. The total mileage of all roads in Austria was 74,265 miles in 1909, and in Hungary 31,800 miles in 1910. The average cost of maintenance in Austria is given at about $311 per mile per annum, and in Hungary $282, exclusive of bridges. In both Austria and Hungary the general government has general supervision over all roads. In Austria the road administration is under the ministry of the Interior, under which there are district engineers, each in charge of 74½ miles of road. Under each of the district engineers are three road masters,each having about 24.9 miles of road, and these in turn supervise the actual road workers or patrolmen, each of whom has about 2.9 miles of road to maintain. There are in all about 4000 men employed on the Austrian government roads. The Hungarian road system is similar and employs about 2500 men.

Denmark

The roads of Denmark are divided into main roads, of which there were 4213 miles in 1910, and local roads, of which there were 22,505 miles in 1910, or a total of 26,718 miles. The main roads are maintained at the expense of the counties, of which there are twenty-one in the kingdom, and the local roads are maintained at the expense of the parishes, which are sub-divisions of the counties. There is a general superintendent of highways who has supervision over all the highways in the kingdom. The direct supervision, however, is by the counties for main roads, and by parishes for local roads. The government does not grant money aid. The principal roads in the kingdom are maintained by a patrol system, under which each patrolman has charge of about 2½ miles of road. The cost of construction varies widely, ranging from about $1300 to about $8700 per mile, the character of construction being usually either gravel or macadam.

England and Wales

There were in 1909–10 a total of 150,908 miles of roads. The roads are divided into main roads and roads other than main roads, the mileage in 1909–10 being respectively 27,826 miles and 123,082 miles. The general government renders aid to road construction and maintenance in three ways; first, through the assignment of certain national revenues, varying in amount, to the aid of local taxation, it being optional with the local authorities as to how much of this fund is spent on roads; second, by loans through the government road board; third, by free grants through the government road board. The government does not supervise the work where it is done with current revenues, but where it is under loan or grant, the sanction of the road board must be obtained and this is generally based on plans and estimates. The assistance granted by the government through loans and grants is for the construction and maintenance of new roads or the road board itself may construct and maintain new roads. The annual cost of maintenance of main roads is given for 1909-10 as $389 per mile per annum. and the roads other than main roads $112 per mile per annum. The amount expended by local authorities in 1909-10 was $32,498,000, not including loans, which amounted to $7,916,964.

France

The roads of France aggregate 520,088 miles and are divided into the following classes: national roads 23,754 miles; department roads 9050 miles; vicinal roads, sub-divided into roads of through travel 107,065 miles, and roads of common interest 47,263 miles (the roads of these two latter classes traversing several communes or towns), ordinary vicinal, which are located within a single commune, 177,580 miles; rural roads, which are unimportant neighborhood roads 155,376 miles. It is estimated that the national roads cost $9000 per mile for construction and $346 per annum for maintenance; the department roads $7400 per mile for construction and $189 per annum for maintenance; the vicinal roads of through travel $4500 per mile for construction and $125 per annum for maintenance; the vicinal roads of common interest $3000 per mile for construction and $95 per annum for maintenance; the ordinary vicinal roads $2000 per mile for construction and $63 per annum for maintenance. The national roads are constructed and maintained entirely at the expense of the national government, which also aids by subsidies to a small extent, the vicinal roads. The departments maintain the department roads. The national government has general jurisdiction over all transportation facilities and direct supervision over the national roads, which are administered by the corps of bridges and roads in the ministry of public works. The corps of bridges and roads is divided into three divisions, of which roads and navigation form one.

The division of roads and navigation is under the direction of a counselor of state and is divided into two sections, namely; bridges and roads, and navigation. The section of bridges and roads is divided into two bureaus, one of which has entire charge of the national roads, and the other has jurisdiction over all matters relating to department roads, automobile traffic and general police regulation. The sections and bureaus and the higher field inspection are under the direction of inspectors general. Each of the inspectors general of the second class have charge of a large field division and under him engineers in chief, usually one to each department, while under these engineers in chief are ordinary engineers and under them are sub-engineers and conductors or foremen and finally the patrolmen who work directly and constantly on maintenance, each having a section of road varying in length, but averaging about 2.8 miles. There were 8560 patrolmen employed in 1909 on the national roads. The engineers for the French road service are trained in the School of Roads and Bridges at Paris and are appointed upon graduation to the lower positions and gradually advanced to positions of responsibility.

The annual expenditure on the public roads of France is about $48,000,000. The national government appropriated in 1910, $9,720,000 for the national roads. It is estimated that the total cost of the entire French road system, excluding the unimportant neighborhood roads, is upwards of $1,100,000,000.

Germany

The imperial govermnent of the German Empire takes no part in the construction or maintenance of public roads. Each state in the Empire follows its own policy in this matter.

As a general rule the roads in the various states are divided into three classes: state or provincial roads; county roads, and local roads. The state roads are generally built and maintained by the state, which maintains a corps of competent engineers. The larger states usually divide their road systems into districts, the engineers in charge of the districts reporting directly to the central office. The patrol system is quite generally followed, each patrolman having from 2 to 5 miles of road to maintain. Their compensation is from $150 to $250 per annum. At the end of thirty years service, or if sooner incapacitated, they are entitled to a pension.

Prussia takes no direct part, however, in the maintenance of roads. The state roads were turned over to the provinces in 1875 and some of the provinces in turn passed them on to the counties. The general government grants aid to the provinces by certain allowances fron the "dotation fund."

The largest class of improved roads in the German Empire is that of the county roads which are very largely maintained by local taxation. The states and provinces, however, exercise close supervision over these roads. The parish roads are purely local and are maintained and managed by the parishes, although occasionally the county and even the province aid in new construction.

There are approximately 36,000 miles of state road in Germany, of which Prussia has 20,489 miles, Bavaria 4200 miles, Saxony 2267 miles, Baden 1890 miles, Wurtembourg 1710 miles, and the smaller states the remainder. Of county roads Prussia has 38,400 miles hard surfaced, parish roads 14,598 miles hard surfaced, and private roads 1100 miles hard surfaced, or a total of 74,587 miles of improved roads, or 1 mile for each 1.8 square mile of area. Prussia expends nearly $35,000,000 a year on all roads, of which about 28 per cent is paid by the provinces, 33 per cent by the counties and 39 per cent by the parishes. Under favorable conditions the cost of construction of state roads does not often exceed $5000 per mile. In Hanover a considerable mileage of brick roads has been constructed at from $10,000 to $13,000 per mile. In the kingdom of Wurtemburg the cost of maintenance of state roads in 1910 was $400 per mile.

Italy

The roads of Italy aggregated 92,199 miles in 1910, and were divided into three classes, namely, national roads, connecting important cities and ports; connecting with roads of other countries; the Alpine and Appennine roads, and those used for military purposes, having a total mileage in 1910 of 5159 miles; the provincial roads, connecting the chief town of each province with the chief towns of other provinces and with maritime ports, having a total of 27,757 miles; communal roads, which are the roads of local interest, having a mileage of 59,283 miles. The national roads are constructed and maintained by the national government through the department of public works. The official in charge is designated as the director general of bridges and roads. The provincial roads are constructed and maintained by the provinces, while the communes or townships provide for the construction and maintenance of communal roads. The national roads are maintained by means of the patrol system, each patrolman having an average of 2¼ miles of road. It is estimated that the cost of maintenance in 1909-10 was $274.70 per mile per annum for national roads, and $183.32 per mile per annum for provincial roads.

Norway

The roads of Norway aggregate 17,550 miles and consist of main roads, 6570 miles, and district roads, 10,980 miles. The national government contributes two-thirds to three-quarters of the cost of construction of main roads, while the maintenance of such roads is, with few exceptions, a local burden. The work is done under county engineers who are nominated by county councils and appointed by the national government. At the head of the whole system, however, is the national road director. It is estimated that the main roads cost about $8000 per mile.

Russia

There are 11,254 miles of post roads in Russia, of which 8326 miles are under direct government control and 2928 miles are temporarily under control of district councils with government supervision. The construction and maintenance of these government roads are partly under the ministry of ways and communications, and partly under the war department. It is estimated that the cost of construction of government roads is from $8544 to $10,874 per mile, and the maintenance from $70 to $210 per mile per annum.

Spain

There were 33,873 miles of road in Spain, in 1910, which were classified as state roads and provincial roads. State roads are constructed and maintained by the general government through the department of public works. Under this department is a director general, and under him a chief engineer for each province. The government also aids, by appropriations, maintenance of provincial roads. The patrol system is followed in the maintenance of state roads. It is estimated that the maintenance of state roads costs between $230 and $240 per mile per annum.

Sweden

There were 35,450 miles of road in Sweden, in 1907, made up of 11,850 miles of main roads and 23,600 miles of district roads. The main roads are those which unite the kingdom with other countries and connect the large cities and ports. The district roads are those of local importance. For the construction of main highways, the government pays two-thirds and the districts one-third of the cost, while on maintenance of these roads, the government pays 15 per cent of the total. The royal board of road building and water works has supervisory powers in road, railroad and harbor construction. The expenditure per mile of road, including all classes, was in 1907, $60 per mile.

Switzerland

There were in 1911, 7426 miles of road in Switzerland which were classified as federal aid canton roads built and maintained by the cantons with federal aid, 350 miles; canton roads, built and maintained by cantons, 862 miles; municipal roads built and maintained by municipalities 6214 miles. The federal government grants aid only to those four cantons whose roads are of international character, the annual aid being as follows: Uri, $15,440; Graubenden, $38,600; Tessin, $38,600; Valais, $9650.

The department of public works in each canton supervises road construction and maintenance, while the upper supervision of the federal government is carried on through the department of the interior. Construction of roads in Switzerland is very expensive on account of the fact that they are practically all mountain roads.

STATE AID LEGISLATION

Revised to January 1, 1915

ALABAMA

The State highway commission consists of a professor of civil engineering in the Alabama Polytechnic Institute, the State geologist, and three civilians appointed by the governor, who hold office for four years. The commission deals with matters of general policy and acts for the highway department in making recommendations to the governor and in all dealings which the highway department may have with the governor and the legislature.

A State highway engineer is chosen by the commission and holds office at their pleasure and he is required to be a competent engineer experienced in road building. He is required to make a general highway plan of the State, collect information, determine the character and supervise the construction of roads built through the aid of the State, and he is further required to prepare a map showing such of the main highways in the State as in his judgment are of sufficient importance to be designated as State roads and which should be improved and maintained at the cost of the State in coöperation with the counties.

A cash appropriation is made and apportioned equally to all the counties in the State on condition that the counties provide an equal amount. Any county desiring such aid shall make a written application to the State highway commission and power is given the State highway engineer to approve or disapprove this application. The preparation of plans and specifications and the actual construction of the roads selected are under the direct control of the State highway engineer, who is also authorized to thereafter require that such roads be kept in proper repair, and if the county fails to carry out the recommendations of the State highway engineer in the maintenance of such road, the State highway commission may prescribe rules under which the work may be done by the State and the expense paid by the county, or if the county defaults, the payment shall be made out of any money due the county from the State aid fund.

The appropriation for the last fiscal year was $154,000 less the expense of operating the State highway department, or an average of $2000 per county. (Approved by W. S. Keller, State highway engineer.)

ARIZONA

The State engineer is appointed by the governor by and with the advice and consent of the senate, and is required to be a competent civil engineer. He prepares plans and specifications for State highways and bridges and all State highway work is done under his supervision. He is also required to aid the county superintendents of roads by giving them advice (office of county road superintendent and county surveyor, abolished January 1, 1915—see county road laws).

For construction purposes an annual running appropriation of $250,000 is made. Seventy-five per cent of this appropriation is to be expended in the counties in which raised under the direction of the county boards of supervisors and the State engineer; 25 per cent to be expended under the direction of the State board of control (the governor, auditor and citizen member, appointed by the governor), and the State engineer. All engineering expenses to be paid out of the 25 per cent portion. (Approved by Lamar Cobb, State Engineer.)

ARKANSAS

An act approved March 31, 1913, provided for forming the State land office into a department of State lands, highways, and improvements, and created in connection with it a State highway commission and a highway improvement fund. The State highway commission is to consist of three members, as follows: Commissioner of State lands, highways, and improvements, chairman; two members to be appointed by the governor to serve, respectively, one and two years; thereafter, as the terms expire, each commissioner appointed shall serve two years. The existence of the State highway commission is limited to thirty years.

The commissioner of State lands, highways, and improvements is required to appoint a State highway engineer subject to the approval of the commission, who shall be a graduate in engineering of some reputable school of engineering and skilled in road building. He holds office for the term of two years.

A highway improvement fund is created, composed of funds derived from motor-vehicle fees and licenses being one-half the total $10 fee or $5 per vehicle.

The department is required to collect data, see that road laws are enforced, hold road institutes at least once a year, which county judges, county engineers, and road overseers are required to attend, and for which they are to receive the same pay as if they were engaged in actual road work. The department is required to furnish plans and specifications when requested to do so, and aid in the formation and management of highway improvement districts. The department is authorized to determine the method of distribution of any State road funds that may be available.

The highway improvement districts are created on application to the county courts, giving description of the roads to be improved and the territory traversed by them. The county court, in the approval of any highway improvement district charter, shall give to the department of State lands, highways, and improvements such specific supervision and control over the highways in question as may be proper and convenient for improvements contemplated in the charter. These applications are forwarded to the department of State lands, highways and improvements, with recommendations by the county judge. The State highway commission then selects the routes to be taken by such highways and provides for laying off the improvement district to be especially taxed for such improvements, and prepares and issues a charter to the district. The State highway commission assesses the benefits upon the property within the district.

The department is authorized to employ State convicts on the public roads or for public road purposes. (Approved by H. R. Carter, State highway engineer.)

CALIFORNIA

The State provided by a referendum vote of the people, effective December 31, 1910, for a bond issue of $18,000,000 under the "State Highways Act," which defines in a general way the roads to be built. This work is under the general direction of the advisory board of the State department of engineering, consisting of the governor, who is ex-officio chairman; the State engineer; the general superintendent of State hospitals; the chairman of the State board of harbor commissioners of San Francisco; and three members appointed by the governor. It is directly administered by the three appointed members, who are designated by a resolution of the advisory board of the department of engineering as the California Highway Commission, and given by resolution full authority over construction of the system of State highways under the $18,000,000 State bond issue. The highway engineer, appointed by the governor, is the executive officer of the commission, and in his charge is placed the construction of the State highways system.

The State highways, in the language of the act providing the bond issue, are being acquired and constructed through the Sacramento and San Joaquin valleys, and along the Pacific Coast, connecting county seats lying east and west of the main routes. This system is to be constructed and maintained at the expense of the State, except that each county must pay into the treasury 4 per cent per annum upon the sum of money expended in such county in the construction of State highways, less such portion of the amount expended as the bonds matured shall bear to the total number of bonds outstanding. The State highways extend from the Oregon boundary to San Diego and El Centre, the most southerly county seats, and are maintained through funds derived from the State license fee imposed upon motor vehicles.

The State department of engineering has general authority over all participations by the State in works of highway improvement, and is given authority to make investigations regarding highway betterment or extension which may be deemed desirable. In addition to the system of State highways, provided by bond issue, such appropriations are made from time to time for construction of roads of State importance, particularly in mountainous sections and in localities where the sparse population makes the expense an undue legal tax burden. (Approved by A. B. Fletcher, State highway engineer.)

COLORADO

The State highway commission consists of a highway commissioner, appointed by the governor, and an advisory board of five members, holding office from one to five years, respectively. The commission is required to meet four times a year and to appoint a secretary, who is required to be a civil engineer and a practical road builder, to hold office at the pleasure of the commission. The commission is required to prepare a map showing the public roads in each county connecting the roads of sufficient importance to receive State aid and form a connecting system of State roads. The commission is given authority to designate the most important roads as the first to be improved. They are also authorized to make investigations to ascertain the location of road material, etc. The commission is given authority to apportion the State road fund among the counties, taking into consideration area, amount of money expended in construction, difficulty and extent of such construction, and extraordinary expenses in connection with the development of new territory. The counties receiving such aid are required to raise an amount equal to the amount set aside by the State, unless the State highway commission should desire to extend further aid to poorer counties, in which case they may extend it to the extent of $5 of State money to $1 of the county's. All money apportioned to counties and not accepted by them is distributed to other counties. The county commissioners are to designate the roads to receive State aid, subject to the approval of the State highway commissioner. The county commissioners must make surveys, prepare plans and specifications, and make estimates and submit them to the State highway commissioner for approval. Contracts are let by the county commissioners after approval by the State highway commissioner. Construction and maintenance are under the supervision of the county commissioners, subject to the approval of the State highway commissioner. The money apportioned by the State highway commission shall be paid to the treasurer of the county on estimates from the State highway commissioner as the work progresses. Annual reports must be made by the county commissioners to the State highway commissioner of all moneys expended on roads during the current year.

Twenty-five per cent of all moneys accruing from forest reservations in the State under act of Congress approved May 23, 1908, shall be apportioned to the counties in which the reservations are situated in proportion to the area of such reservations in the respective counties. No less than 5 per cent of such fund shall be expended for schools, in the discretion of the board. An additional 10 per cent of the earnings of the Forest Reserve is set aside and expended for roads and trails in the reserve under the direction of the forestry department. Appropriations for State highways are made directly by the legislature.

An act of the legislature passed in 1913 providing that the county commissioners in counties having a revenue of $12,000 or more may elect a county road supervisor to have entire supervision of all the roads and bridges in the county. He is required to make a complete report on the first of each month, which report after approval by the county commissioners is forwarded to the State highway commissioner. He is required to attend at least one meeting annually at the capitol called by the State highway commissioner. His other duties are explained in the chapter on "Local Road Legislation." (Approved by J. E. Maloney, secretary, State highway commission.)

CONNECTICUT

A State highway commissioner, who shall be a capable road builder, is appointed by the governor with the consent of the senate and holds office for four years. He has a right to enter any town in the State and lay out and improve any trunk line roads and certify the cost of the same to the State comptroller for payment. He has authority to approve the application of the selectmen of any town for State aid, to select the highway to be improved with such aid, make surveys, plans and specifications therefor, determine the character to the road, and have supervision of the construction. He has the right to reject any and all bids, and where the cost is less than $1000 he may at his discretion, permit the town to do the work. He shall keep all State roads in repair and certify the cost of the comptroller. He is authorized to appoint a deputy commissioner, eight division engineers, and such other assistants as he may deem necessary and fix their salaries.

Whenever any town desires to improve a public road by the aid of the State the selectmen of the town shall make application to the State highway commissioner for such aid, such application to be subject to his approval. The aid granted by the State is apportioned as follows: In towns having a taxable valuation of over $1,250,000 the State pays three-fourths of the cost of roads constructed as State aid roads, and in towns having a valuation of $1,250,000 or less the State pays seven-eighths of the cost of such construction, the whole amount to be paid by the State in any one year being $500,000. The sum so expended shall not exceed $10,000 per town in any one year. The law permits the use of two years appropriation in one year. A trunk line system, comprising the principal roads of the State laid out and amended by the legislature of 1913 is gradually being constructed and maintained entirely at the cost of the State, provided the total amount expended for such trunk line to September 30, 1915 shall not exceed $2,000,000 under the new appropriation. The State highway commissioner is authorized to lay out, widen and grade any highway in the State whenever he deems it necessary for the purpose of connecting with the trunk line highways. Under the new law, towns are permitted to improve State aid roads with their own funds and recover their proportion of the cost of said improvement under a subsequent appropriation by the State. Said work must be done under the supervision of the State highway department and must not exceed an amount designated by said department.

The maintenance of trunk-line roads is paid for entirely by the State, while the maintenance of State roads other than those on the trunk lines is borne by the State and town in the ratio of three-fourths and one-fourth respectively. All moneys received by the State from automobile licenses and fines, amounting at present to about $350,000 are for road maintenance. The State issues State bonds for building of State highways, and the law of 1913 provides for the issuance of said bonds for this purpose. Additional appropriations are made, as necessary, for maintenance.

There is an appropriation of $1,000,000 for the two years ending September 30, 1915, for the improvement of State aid roads. Of this $1,000,000, the towns in which work is done, are obliged to contribute either one-quarter or one-eighth of this amount. (Approved by Charles A. Bennett, State highway commissioner.)

DELAWARE

There are three counties in the State one of which, New Castle County, has a State highway commissioner for the county, appointed by the governor. As the duties of the commissioner relate only to the one county further information is given in a chapter on "Local Road Legislation."

DISTRICT OF COLUMBIA

The commissioners forward to congress, through the secretary of the treasury, estimates of proposed expenditures for each fiscal year ending June 30. To the extent to which these estimates are approved, inasmuch as the National government owns fully one-half in value of the property in the District, congress appropriates 50 per cent, and a like proportion is paid from the District revenues. (Approved by Captain W. D. A. Anderson, Corps of Engineers, U. S. A., assistant to engineer commissioner, D. C.)

FLORIDA

The State government has no highway department and does not grant aid to road construction.

GEORGIA

Georgia has no State highway department and grants no State aid in the form of money. All male felony convicts are apportioned to the several counties for work on the public roads, the apportionment being on the basis of population. This aid is under the supervision of the State prison commission, which is authorized to purchase road machinery, appliances, and teams and equip and organize such convicts in road forces. (Approved by Dr. S. W. McCallie, State geologist.)

IDAHO

The present State highway department was created by the 1913 legislature and consists of a State highway commission of five members including ex-officio, the State engineer, secretary of state, and the professor of civil engineering of the State University, and two civilian members appointed by the governor. The engineering department is under the direction of a State highway engineer appointed by the commission. The legislature authorized a State bond issue of $200,000 to aid in the construction of proposed State roads on the plan of the State bearing one-third of the cost of construction and the county two-thirds. The location, surveys, estimates, etc., are made at the expense of the State and the roads are built under the supervision of the State highway engineer under contracts which are let by the State highway commission. After completion all roads of this kind are maintained at the expense of the State. (Approved by Edward S. Smith, State highway engineer.)

ILLINOIS

Under the road and bridge law, approved June 27, 1913, a State highway commission of three members was appointed by the governor, one for two years; one for four years, and one for six years; and thereafter one every two years. A chief State highway engineer and an assistant State highway engineer are also appointed by the governor, each to serve for six years and until their successors are appointed and qualified. All are appointed with the approval of the State senate.

The State appropriated $400,000, 1913–1914, and $700,000 1914–1915, for State aid roads. An equal amount must be raised by the various counties in order to make these appropriations available. Also in addition $100,000 per annum for engineering and experimental work.

Counties in order to meet allotments made to them by the State highway commission may raise money to meet their proportion by special tax, or by issuing bonds if there is not enough money in the county treasury to meet them by direct appropriation.

State aid roads and bridges are constructed at an expense of one-half paid by the county and one-half by the State, but the State will forever maintain roads and bridges so built under the direction of the State highway commission.

Provisions are made for construction of highways and bridges on county lines other than State aid roads by joint action of the counties. Also for construction by joint action of the counties and townships interested. (Approved by W. W. Marr, chief State highway engineer.)

INDIANA

The State has no highway department and does not grant aid in any form toward road construction and maintenance.

IOWA

By the act of the thirty-fifth general assembly, a State highway commission was created in Iowa with much more power than the former commission. Two members of the commission,

J. W. Holden, and H. C. Beard, are appointed by the governor from opposite political parties. A. Marston, dean of engineering at the Iowa State College is the third member of the commission.

These commissioners have organized their engineering force, under Thos. H. MacDonald, highway engineer, working in three departments: designing, field, and educational. The designing department is under the direction of C. B. McCullough; the field department is in charge of F. R. White; and the educational department is directed by J. S. Dodds. The field work of the commission is in immediate charge of six division engineers who cover the whole State and report to the field engineer.

The highway commission is charged with the supervision of the road and bridge work of the State. This work is in direct charge of the county and township officers assisted by the county highway engineer. The township officers have charge of construction and maintenance of the township road system which embraces about 85 per cent of the mileage of the county. The county officers build all bridges and culverts and have charge of the county road system made up of those roads not in the township system. The county system, made up of those roads which connect the trading points and the adjoining county systems but not to exceed 15 per cent of the entire mileage of any county are the main traveled roads and constitute a complete network of roads covering the State.

All bridge and culvert work must comply with the highway commission standards. Contracts for single structures costing over $2000 must be approved by the highway commission. All plans for permanent road grading, drainage, and surfacing must be approved by the commission. Standard plans and profiles are made for each mile of road so improved.

An excellent feature of the law is the resolution of necessity required to be published to inform the public of the intention to build structures costing over $300. This resolution must describe the location of proposed structure, dimensions, drainage area, material of construction, and estimated cost of all contemplated work.

KANSAS

The State grants no money aid for road improvement, but the office of State engineer has been established at the Kansas State agricultural college for the purpose of giving advice throughout the State in connection with the construction and maintenance of roads and bridges, drainage, and irrigation. The appropriation is about $10,300 per annum. (Approved by W. S. Gearhart, State engineer.)

KENTUCKY

By an act passed in March, 1912, the governor was required to appoint on July 1, 1912, and every four years thereafter a State commissioner of public roads, who shall be a graduate in civil engineering from some reputable university or some technical college and have had at least five years' experience in civil engineering. The expenditures chargeable to the State road fund were limited to not to exceed $25,000 per annum. The commissioner is authorized to collect and disseminate information, furnish plans, specifications, and estimates of cost of bridges and roads, but it is not obligatory on the part of local officials to accept such plans and specifications, but they must be kept on file in the office of the county road engineer, as are the plans, specifications, and actual cost. He is also required to hold an examination for the appointment of county engineers, and such county engineers shall, upon order of the State commissioner, cause all roads within their counties to be measured and shall make report to the said commissioner.

The General Assembly of 1914 passed a bill which levied a State tax of five cents on the $100 of taxable wealth, which is to constitute a State road fund to be redistributed to the counties applying for aid to the extent of one-half the cost of construction or reconstruction of public roads. No county to receive in any one year more than 2 per cent of the total fund.

Also another bill was passed, making roads connecting the county seats of adjoining counties or the most direct and practical route, public State highways, to be the first to receive State aid. (Approved by Robert C. Terrell, State highway commissioner.)

LOUISIANA

The board of State engineers is authorized to appoint a State highway engineer, who holds office until removed for cause by the board. He is required to be a competent civil engineer, experienced in highway work. The board is authorized to appoint assistants and clerks and provide offices; to hold meetings in its discretion for considering the general policy of the department and receive the annual report of the State highway engineer. The board acts in all matters concerning recommendations, estimates, etc., to be submitted to the governor.

The State highway engineer is required to make a general highway plan of the State, collect statistics, establish standards for construction and maintenance, have supervision over construction and maintenance of State highways on which State aid has been granted, subject to the approval of the board of State engineers. He or his assistants must make all surveys, plans, specifications, and estimates and select material for such State highways. He awards contracts, but may reject any and all bids and conduct the work with his own force. He is authorized, with the approval of the board of State engineers, to purchase, for the State, road machinery, draft animals, and supplies, and loan such equipment to the parishes. Upon completion of contract for State highways the State highway engineer certifies to the State treasurer and the president of the police jury the portion to be paid by the State and parish respectively.

The State highway engineer is required to keep all roads improved as State highways in repair, the total cost to be paid by the State and the parish to reimburse the State in the same manner as for construction. He is required to organize a system of repair whereby all roads may be in good condition at all times.

The initiative in obtaining State aid rests with the police juries of the respective parishes. They make application to the State highway engineer for State aid in the improvement of main traveled roads, and the said State highway engineer must take up such applications as far as practicable in the order of their receipt, provided the parishes have raised their portion of the cost of such improvement.

In order to provide a State aid fund all surplus revenues received by the oyster commission and the game commission and from any State vehicle tax and from a general property tax of one-fourth of 1 mill, are placed in a fund known as the State highway fund. This fund is apportioned by the State highway engineer with the approval of the board of State engineers.

The State engineer may, with the approval of the board of State engineers, use convicts for highway work, the labor to be furnished free of charge, and the cost of maintenance and operation to be borne by the parishes or districts. (Approved by W. E. Atkinson, State highway engineer.)

MAINE

Under an act passed in 1913 "the governor with the advice and consent of the council shall appoint a State highway commission consisting of three members; one to serve three years, one to serve two years and one to serve one year.

"The commission shall select, and with the approval of the governor and council appoint a chief engineer, upon terms to be fixed from time to time by the commission, subject to the approval of the governor and council."

He shall under the direction of and control of the commission have general charge of the office, the records and all construction and maintenance work, and may with the approval of the commission employ necessary clerical assistance. The engineer may with the approval of the commission employ such other engineers, supervisors, assistants and help as he may deem necessary.

The commission shall lay out, construct and maintain a system of State and State aid highways. The State highways to be constructed wholly by the State from the bond issue. The State aid highways to be constructed by the State and municipalities jointly. Both classes of highways to be maintained under the direction of the commission, the cost to be borne jointly by the State and municipalities. The charge against the municipalities for maintenance of State highways shall be $60 per mile per annum; for State aid highways, the charge shall be one-half the actual expense but not to exceed $30 per mile per annum.

The commission have full power in the letting of all contracts for the construction of all State and State aid highways. The commission may make contracts with towns for construction of State aid roads without advertising for bids.

Towns may make the following appropriations and apply for State aid:

Towns having a valuation of $200,000 or less may appropriate any amount, not exceeding $300; towns having a valuation of over $200,000 and not over $800,000 may appropriate any amount not exceeding $533; towns having a valuation of over $800,000 and not over $1,000,000 may appropriate an amount not exceeding $600; and towns having a valuation of over $1,000,000 and not over $3,000,000 may appropriate in addition to the sum of $600 an additional sum of $66 for each $200,000 or fraction thereof valuation in excess of $1,000,000; towns having a valuation of over $3,000,000 and not over $4,000,000 may appropriate, not exceeding $1333, and towns having a valuation of $4,000,000 may appropriate in addition to the sum of $1333 an additional sum not exceeding $133 for each additional $1,000,000 of additional valuation.

The commission from the funds for State aid construction shall to each town which has conformed to the provisions of the act, for each dollar so appropriated, apportion the following amounts:

To each town having a valuation of $200,000 or less, $2 for each dollar appropriated by said town; to each town having a valuation over $200,000 and not over $1,000,000 $1 for each $1 appropriated by said town; to each town having a valuation of over $1,000,000 and not over $1,200,000 92 cents for each $1 appropriated by said town; to each town having a valuation over $1,200,000 and not over $1,400,000, 85 cents for each $1 appropriated by said town; to each town having a valuation over $1,400,000 and not over $1,600,000, 80 cents for each $1 appropriated by said town; and to each town having a valuation over $1,600,000, 75 cents for each $1 so appropriated by said town. The money appropriated by towns applying for State aid with the amount apportioned by the commission shall constitute a joint fund for the construction and improvement of the State aid highways in such towns.

After the year 1913, between the 15th day of July and the 15th day of August in each year, municipal officers shall prepare and file with the commission, suggestions for the improvement during the next calendar year of State aid highways located in each town accompanied by plans so far as practicable, setting forth the location of the highway and the nature of the improvement desired. The commission shall examine and report thereon with its recommendations to the muncipal officers on or before the 20th day of February following. Such reports shall be submitted to the voters of such towns at the next regular meeting.

To provide funds for the construction of State aid highways there shall be appropriated for the year 1913 the sum of $250,000 and annually thereafter there shall be appropriated the sum of $300,000. To provide for the administration of the office and duties of the commission and for all expenditures, salaries and expenses incident thereto, and for the maintenance of all State and State aid highways there shall be appropriated the sum of $50,000 annually. For the construction of the State roads the treasurer of State is authorized under the direction of the governor and council to issue from time to time serial coupon bonds, not exceeding $2,000,000 in amount outstanding at any one time, payable at the State treasury within forty-one years from date of issue; the interest on the bond issue and retirement of bonds to be provided for from the automobile license fees. Not more than $500,000 of bonds shall be issued in any one year.

The fund for maintenance and administration is augmented each year by the balance remaining on the 31st of December in the appropriation for State aid highways; that is, so much of the State's appropriation for this purpose as has not been apportioned to municipalities on account of State aid is automatically carried into the fund for administration and maintenance for the succeeding year. This fund is further augmented by the balance remaining in the fund created by the licensing of automobiles after providing for the payment of interest on the bonds issued and a sinking fund for the retirement of bonds. (Approved by Paul D. Sargent, chief engineer, State highway commission.)

MARYLAND

The State roads commission consisting of six members appointed by the governor has direct control over the construction and maintenance of a system of main highways through all the counties in the State, the cost of such construction and maintenance to be borne entirely by the State. The commission also has authority to approve applications for State aid on roads not included in the trunk-line system, and when such applications are approved the plans and specifications are prepared by the State, the contract awarded by the counties subject to approval of the State, and the performance of the contract supervised by the State.

The cost of State aid roads is shared equally by the State and counties. The allotment of State funds to the counties is based upon road mileage. After the construction of a State aid road its maintenance devolves upon the county authorities subject to the approval of the State. The revenues from the automobile-license law go to the maintenance of State and State aid roads according to their mileage after deducting 20 per cent for Baltimore City.

A system of trunk-line roads, built and maintained entirely at the expense of the State, was authorized by the legislature in 1908, and a State bond issue of $5,000,000 was authorized for this purpose. An additional bond issue of $1,000,000 was authorized by the legislature in 1910, and in 1912, a bond issue of $3,170,000 was authorized. The trunk-line system is selected entirely by the State roads commission and every stage of the work is completely under the control of the commission. A chief engineer selected by the commission is the executive officer and active head of the work. The funds for State aid roads as distinguished from State roads are provided by direct appropriation. The legislature in 1912 provided that an annual State tax of 1 cent on each $100 should be levied to provide a maintenance fund for State highways. (Approved by Henry G. Shirley, chief engineer, State roads commission.)

MASSACHUSETTS

A State highway commission consisting of three members appointed by the governor for a term of three years, one term expiring each year, has control over the construction and maintenance of roads, partially or wholly paid for by the State.

The duties of the commission relate to roads and automobiles. Its duties so far as they relate to roads are: (*a*) The collection of statistics as to road materials and road conditions in the State, the making of maps, the giving of advice to local road authorities, etc.; (*b*) the laying out and construction of State highways, the improvement of certain town roads, and the supervision of maintenance of State highways.

The State highways are such as are designated by the commission upon petition of the city government, the board of selectmen, or the county commissioners. As soon as a highway has been thus designated, it passes under complete jurisdiction of the State highway commission, which has control not only of construction and maintenance but also of the location of water and gas mains, poles or other structures, the planting or cutting down of trees on the right of way, etc.

The cost of constructing State highways is borne as follows: 75 per cent by the State and 25 per cent by the county in which the highway is located, the State paying the entire cost on the first instance and collecting as a refund the 25 per cent from the county.

In order to aid the small towns, 15 per cent of the amount appropriated annually for State highway construction may be expended as follows: 5 per cent in towns of less than $1,000,000 valuation, upon petition, the town making no contribution; 5 per cent in towns of less than $1,000,000 valuation, the towns contributing an equal amount; and 5 per cent in towns of more than $1,000,000 valuation, the towns contributing an equal amount, which amount must be in excess of its average annual appropriation for roads for the last five years.

This has been amended by the acts of 1913, chapter 774, which provides that when any road has been constructed or improved, in whole or in part, with money furnished by the commonwealth, and is not laid out as a State highway, the city, town, or county shall at all times keep it in good repair and condition. The commission shall from time to time notify the authorities in charge of the road whenever it is not so kept in condition, and shall specify what repairs or improvements are necessary, and said authorities shall forthwith proceed to make the specified repairs and improvements. If not made within sixty days (unless further time is allowed) the commission may do the specified work and pay for the same from any money available for the maintenance of State highways or from the part of the motor vehicle fees' fund available for work on through routes in the towns (20 per cent of the net). The amount of such expenditures shall be collected back in the manner in which the expense of repairs on State highways is collected (see above). The money collected to be available for use for the same purposes for which the money so expended was available, or for the repair and maintenance of State highways: but in towns of under $1,000,000 valuation not more than $50 a mile a year; in towns with a valuation of over $1,000,000 and under $2,000,000 not more than $100 a mile a year, and in towns with over $2,000,000 valuation not more than $200 a mile a year shall be collected in any one year; but any balance due may be collected in succeeding years, the maximum collection in any one year being as above stated. The commission may upon petition exempt any town from the whole or any part of such payment if in its judgment said payment would prove to be an undue burden.

The State highway commission maintains the State highways at the expense of the State in the first instance, and the counties are required to repay to the State 25 per cent of the amount expended by the State for maintenance. This has been amended by the acts of 1913, chapter 773, so that not exceeding $50 a mile a year is collected back from towns of under $1,000,000 valuation; not exceeding $100 a mile a year from towns whose valuation is from $1,000,000 to $2,000,000; not exceeding $200 a mile a year from towns whose valuation is from $2,000,000 to $5,000,000 and in cities and towns of a valuation of over $5,000,000, one-half said expenditures, not exceeding $2000 a mile in the aggregate, and not exceeding $500 a mile in any one year, shall be made a part of the State tax and collected, and any balance due may be made a part of the State tax for the succeeding three years. The amount collected shall be credited to the appropriation for State highways, to be used again by the commission.

The State road revenues are derived from State bond issues, usually authorized for five years, one-fifth of the amount authorized to be issued each year during the five-year period. The present bond issue is at the rate of $1,000,000 per annum. Of the automobile fees and fines, after deducting the expense of administering the automobile department, 80 per cent is applied to the maintenance of State highways, and 20 per cent is spent on through routes in the towns. The net fees, fines, etc., now amount to from $500,000 to $600,000 per annum. In addition, the legislature makes direct appropriations from time to time to meet special expenses and additonal maintenance cost. The towns in 1914 appropriated over $300,000 of their own money to go with the $150,000 State aid money and the $150,000 motor vehicle fee money appropriated by the Commission for road improvement in the towns. Work was done in 169 towns with these two funds in addition to the building of State highways.

As indicating the manner in which the law is carried out in relation to road construction by the State highway commission, it may be stated that contracts are awarded by the commission to the city or town in which the highway is to be laid out, if prices are satisfactory to the commission and if the contract is accept-able to the local authorities. The work is then done by the local authorities under the direction of the commission and its engineers. The contracts for State highway construction are usually based on given unit prices for each item of work, while the small town contracts are on the lump-sum basis. If the local authorities do not take the contract, bids are advertised for and awarded in the usual way.

The organization of the commission is as follows: A central office at Boston with three commissioners, a secretary, the various assistants in the highway department, the motor-vehicle department, and a chief engineer. The State is divided into four divisions each in charge of a division engineer, who has the necessary assistants and resident engineers, who are employed directly on the work. State issues bonds for road construction. (Approved by Col. Wm. D. Sohier, chairman, Massachusetts highway commission.)

MICHIGAN

The law provides that in 1913 and every four years thereafter a State highway commissioner shall be nominated and elected by the people at the same time and in the same manner as the justices of the supreme court. He is required to be a citizen of the State and may appoint a deputy, who shall be a civil engineer skilled in road building, and such other assistants as may be necessary. His duties are to give instruction in road and bridge construction and maintenance, to collect statistics, and distribute State-reward funds or any funds given to the State for such purposes by the United States government or by individuals. He is required to give expert advice to the local authorities and is required to make a map of every township in the State showing the roads and their condition and the location, kind, and quantity of road materials, etc. His decision is final as to whether a road merits State reward, and he may withhold any portion of the reward until the road has been thoroughly tested.

Whenever any township board or board of county commissioners have made arrangements to improve a mile or more of public road by constructing a sand-clay, gravel, stone-gravel, gravel-stone, macadam, concrete or brick road and ask for an allotment of State reward, and file with the State highway department a profile of the highway to be improved, and make application for plans and general specifications, the State highway commissioner shall furnish the plans and specifications and allot the funds from the State treasury as the State reward if, after completion, he finds the road to be up to the required standard. Each surveyed township is entitled to receive State reward on no less than 1 or more than 4 miles of road in any one fiscal year. The reward is allotted as follows:

a. Each mile of well graded road, with grade not exceeding 6 per cent, except where found impracticable and a steeper grade is recommended after examination by the State highway commissioner, width not less than 20 feet between side ditches, properly drained, with travel track not less than 9 feet, made of a mixture of sand and clay, shall merit if approved by the State highway commissioner, a reward of $250 per mile, and pro rata for extra miles, with an extra $25 for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

b. Every mile of well graded road having not to exceed 6 per cent grade, except where found impracticable and a steeper grade is recommended after examination by the State highway commissioner, width not less than 20 feet between ditches, well drained, travel track not less than 9 feet, surface not less than 8 inches compacted gravel applied in not less than two courses, each rolled separately, shall merit, if approved by the State highway commissioner, a reward of $500 per mile, with an extra $50 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

c. Every mile of well graded road having not to exceed 6 per cent grade, with not less than 20 feet between ditches, well drained, travel track not less than 9 feet and having a foundation not less than 4 inches of crushed stone, slag or other material compacted, and top course of layer of gravel not less than 3 inches, shall merit, if approved by the State highway commissioner, a reward of $750 per mile, with an extra $75 for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

d. Every mile conforming to the above conditions as to grade, width, drainage, etc., and having a bottom course of gravel, slag or other material not less than 4 inches thick after rolling and a top course of crushed stone not less than 3 inches thick after rolling shall merit, if approved, a reward of $750 per mile, with an extra $75 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

e. Every mile conforming to the foregoing as to width, grade, drainage, etc., and having a surface of well compacted macadam not less than 6 inches thick laid in not less than two courses, each properly bonded, shall merit, if approved, a reward of $1000 per mile, with an extra $100 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

f. Every mile conforming to the foregoing as to width, grade, drainage, etc., and having properly laid concrete not less than 6 inches in thickness with or without a paving brick surface, shall merit, if approved, a reward of $1000 per mile, with an extra $100 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

g. Every mile conforming to the foregoing as to width, grade, drainage, etc., and consisting of a paving brick surface laid on gravel, sand, broken stone or slag, the quality of brick, manner of laying and kind of inspection employed to be made to comply with the specifications made by, or approved by the State highway commissioner, shall merit, if approved, a reward of $1000 per mile, with an extra $100 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

Two or more townships may act jointly in the improvement of boundary line roads.

Upon application by the highway officials to the wardens of the various State penitentiaries, State prisoners may be put to work upon the highways or may be used in quarries for preparing road material.

The 1913 legislature of Michigan passed what is known as the trunk line highway act, which delineates certain highways leading from town to town in the State, totalling about 3000 miles, upon which townships and counties will be entitled to double the State rewards mentioned above, when they build roads according to specifications drawn by the State highway department. The fixing of the location of these routes between towns, the preliminary surveys and the drafting of specifications are in the hands of the State highway department, while the construction of the roads is in the hands of the townships and counties through which they pass. (Approved by Leroy C. Smith, deputy State highway commissioner.)

MINNESOTA

The State highway commission consists of three members appointed by the governor and holding office for three years and serving without compensation, one new commissioner to be appointed each year. The commission holds meetings not less than once in each month and appoints a secretary who shall be a civil engineer and practical road builder and be known as the State engineer, and holds office subject to the pleasure of the commission. They may also employ other assistants and fix their compensation. The commission shall make report to the governor annually.

The State engineer is required to give advice under the rules of the commission and to perform such other engineering services for other State departments as the governor may require. He shall make all necessary surveys, establish grades, prepare plans and specifications, and have supervision of all work on State roads. He shall make an annual inspection of all bridges exceeding 30 feet in length, shall make report on their condition with recommendations to the State highway commission and county boards. The commission is authorized to investigate the location of road materials, investigate methods of construction, systems of road administration, hold public meetings, and apportion State aid.

A State road fund is created by an annual tax levy of 1 mill on each dollar of valuation, together with all money accruing from investments in the internal improvement land fund. The State highway commission allots this fund to the various counties, but no county shall receive in one year more than 3 per cent nor less than 1 per cent. Twenty per cent of the allotment shall be used only for maintenance of State roads and bridges. In determining the percentage accruing to each county the commission shall take into consideration the area, the amount of money expended in road construction, the difficulty and expense of such construction, and the extraordinary expense connected with the development of new territory.

Any county board may with the consent of the highway commission designate any established road in the county as a State road, and, if the cost does not exceed $500, cause surveys to be made when necessary by a State assistant engineer and then proceed with the construction. If the cost is over $500 the county board shall cause survey and plans and specifications to be made by the assistant State engineer and submit the same to the State highway commission for approval. When such approval has been obtained the county board proceeds to do the work under the supervision of the assistant State engineer, who acts under instructions of the State engineer. After completion, if the State highway commission approves the work, the State engineer certifies to the same and a warrant is issued by the State auditor for a share as provided by the law of the amount expended, but in no case shall the warrant exceed the amount allotted to such county. The assistant engineers throughout the State are appointed by the State highway commission and act under the instructions of the State engineer. The appropriation for State highway department is $150,000 per annum. (Approved by Geo. W. Cooley, State engineer.)

MISSISSIPPI

Mississippi has no State highway department, and the control of the roads, ferries and bridges of the State is vested in the county boards of supervisors by the constitution.

MISSOURI

The State highway commissioner is appointed by the governor for a term of four years. The highway commissioner also appoints a deputy engineer. The duties of the State highway commissioner are to devise plans and estimates for road and bridge construction and hold public meetings, to give assistance and advice to local road officials, to issue bulletins, etc. He has authority over road work and over the distribution of State aid apportioned to the counties, but his work is also investigative and educational

The first State aid for roads in Missouri was the equal division of the war debt fund of $475,000 among all the counties in 1907. This was given without condition and without any supervision of its expenditure by State authorities. At the present time a State tax is levied upon certain market transactions and is known as the "stamp act." The income from this act was about $26,846 in 1913 and was distributed among the counties in proportion to the school attendance. The automobile licenses yielded $173,810.50 in 1913 and this fund is disbursed: $225,000 for the biennial period for dragging of roads, county seat to county seat, or actual mileage and at $15 per mile per year payable monthly on requisition on auditor approved by the State highway commissioner. This fund, owing to mileage being much more than makers of bill estimated, will only cover a period of about one year, but by reason of the State highway commissioner holding back approval of requisitions and the lapse of time necessary to get roads approved, the fund will be nearly sufficient for the needs of the counties. Where roads cannot be dragged the law may be applied for betterment. There is also another law which when parties put up a certain sum with the county court the said court must, if they have funds, give a like amount, and then the State is drawn on for an amount equal to what both the individual and county has advanced but no county shall receive in any one year more than 3 per cent of the whole amount. The plans for work costing more than $1,000 per mile shall be approved by the State highway commissioner.

There goes into the general good roads fund all monies received from corporation fees, which amounted in 1913 to $77,873,59. (Approved by Col. Frank W. Buffum, State highway engineer.)

MONTANA

Under an act of the legislature passed in 1913, the governor is required to appoint a State highway commission of three members consisting of the professor of civil engineering of the Montana State College of Agriculture and Mechanic Arts, ex-officio; the State engineer, ex-officio; a civil engineer who is a trained and experienced road builder, who shall hold his office subject to the pleasure of the governor and act as secretary of the commission. He is required to devote his entire time to the work and is to receive a salary of not to exceed $3500 per annum. Each ex-officio member of the commission is to receive a per diem of $10 while the commission is in session, in addition to their actual and necessary expenses, provided that no ex-officio member shall receive for services and expenses a sum in excess of $1200 per annum. The commission is required to meet not less than once a month. The duty of the commission is to give advice, assistance and supervision in regard to road construction and maintenance, throughout the State. The attorney-general is made ex-officio attorney for the commission.

The board of county commissioners in each county is required within six months after the passage of the act to have prepared duplicate road maps of all public roads in the county as well as public roads constituting boundaries between counties and designate on the map such roads as the county board considers of sufficient importance to justify their improvement under this act. One of the maps is filed with the county clerk and the other is forwarded to the State highway commission with a statement of the location in the county of all deposits of road material. If the county board fails to carry out the provisions of the act, the State highway commission may proceed to obtain the information and deduct the amount thus expended from the first apportionment to such county.

The State highway commission is required on or before January 1, 1914, to prepare a map showing all public roads in each county, and all roads which the commission deems of sufficient importance to entitle them to State aid. The commission may in coöperation with the county commissioner divide the roads into two classes, one of primary importance and the other of secondary importance, the primary roads to be the first improved.

A State highway fund is created consisting of $5000 direct appropriation to pay the expenses of the commission until the amount credited to the State highway fund is available, thereafter the expenses of the highway commission to be paid out of the said highway fund. There does not seem to be any further provision in the act looking to the appropriation or creation of a State highway fund, although the motor vehicle law provides the motor fees shall be apportioned in the same manner as the State highway fund.

The act states that on or before the first Tuesday of March of each year the highway commission shall apportion the State highway fund among the different counties of the State and notify their respective boards of county commissioners. The highway commission is given discretion as to the amounts to be apportioned to the representative counties and is required to take into consideration the area of the county, the amount of money to be expended by it, the difficulty and expense of road construction and extraordinary expenses connected with the development of new territory. The commission is not allowed to spend any of the funds within the corporate limits of cities or towns or in any of the counties in which the county commissioners have not provided for the raising of an amount equal to the amount set aside by the State highway commission. If any county within ninety days fails to avail itself of the act, the highway commission may apportion its allotment among the other counties. The commission is authorized to adopt rules and regulations for the construction and maintenance of State roads. The board of county commissioners is required to make the necessary surveys, plans, specifications and estimates for State roads, in accordance with rules and regulations of the State highway commission, which is authorized to approve or disapprove of the same. The actual construction or maintenance of State roads is under the direction of the State highway commission. The boards of county commissioners may for such work employ a competent civil engineer at not to exceed $12 per day. Contracts are let by the boards of county commissioners.

The boards of county commissioners are required to make a report on or before December 30 of each year to the State highway commission showing in detail all money expended by such county during the current year in the construction and maintenance of the public roads. One part of the report shall cover State roads and the other portion cover all other roads.

The State highway commission is required to make a biennial report to the governor.

NEBRASKA

The county board of commissioners is required to have bidders on bridge work use forms provided by the secretary of State board of irrigation. The county board is forbidden to let a contract for a bridge costing over $500 except upon plans and specifications of the secretary of the State board of irrigation, who is required also to inspect and check that completed work.

The State board of irrigation is constituted by law. The State board of supervision for bridges and the State engineer is empowered to carry out the orders of the board.

The board of county commissioners may make application to the State board of irrigation for State aid in the construction of any bridge over a stream of 175 feet or more in width, pledging the county to furnish one-half the cost of construction, and, if the application is approved by the State board, the contract is let jointly by the said county board and the State board of irrigation. The plans and specifications are furnished by the State engineer and the construction is under the joint supervision of the State board of irrigation and the board of county commissioners. A State levy of one-fifth of 1 mill on the dollar constitutes the "State aid bridge fund."

The State board of irrigation, highways and drainage is empowered to advise with county boards on highways and bridges. The board is authorized to establish an advisory board of three members to supervise the expenditure of any funds that may be provided by the federal government for highway and bridge construction.

NEVADA

A law passed by the legislature of Nevada, and approved by the governor March 16, 1911, provides that the State engineer shall have general supervision of road work carried on by convict labor. An appropriation of $20,000 was made to cover the work, which was more in the nature of an experiment with convict labor than of expecting any large results from so small an appropriation. No appropriation was made by the last legislature to continue the road work with convict labor. A brief outline is all that can be given, regarding the road work under State supervision for the period of 1911–1912. The above statistics, of course, may be used to head the report.

On June 1, 1911, work was commenced on a State highway between the cities of Carson and Reno; about 1½ miles of standard macadam road was constructed on the Carson end of the road; about 6 miles of road shaped and filled on the Reno end of the road. The type of construction used on the Reno end of the road was macadam, using a rock which was found about 5 miles from Reno and which proves to be an excellent road material. A total of about 20 miles of the road was repaired to permit of fast auto travel the entire distance. (Approved by W. M. Kearney, State engineer.)

NEW HAMPSHIRE

The governor and council have authority to appoint a State engineer and necessary assistants and fix their compensation. The governor and council shall act upon all applications for State aid and apportion the aid among the counties, cities, and towns making application. The State engineer, under authority of the governor and council, prepares plans and specifications for all State aid road work. The governor and council, through the State engineer, are required to designate for improvement three continuous highways known, respectively, as the East Side Road, the Merrimac Valley Road, and the West Side Road. On these roads the towns receive at least dollar for dollar from the State and additional amounts as governor and council may decide. The legislature of 1913 provided for an east and west route and appropriated $100,000, and the Ossipee-Meredith route with an appropriation of $25,000.

Aside from the State highways the State grants aid to the towns on the following plan:

Each town, out of the money raised for highway purposes, shall set aside the following amount for the improvement of its highways under the supervision of the State engineer: Towns having a valuation of less than $2,000,000, $1 on each $1000 valuation; towns of $2,000,000 and less than $3,000,000 valuation, 75 cents on each $1000 valuation; towns of $3,000,000 and less than $5,000,000 valuation, 50 cents on each $1000 valuation; towns of $5,000,000 and less than $15,000,000 valuation, 33⅓ cents on each $1000 valuation; towns from $15,000,000 and upward valuation, 25 cents on each $1000 valuation; counties in which are located unincorporated towns, $1 on each $1000 valuation. If a town desires State aid for permanent improvement in addition to the improvement provided by the foregoing method, it shall raise an additional amount equal to 50 per cent of this sum and then make application for State aid. They shall then receive for each additional dollar so set apart the following amounts: Towns having a valuation of less than $100,000, $3 for each $1 so set apart; $100,000 and less than $150,000, $1.25 for each $1; $250,000 and less than $500,000, 60 cents for each $1; $500,000 and less than $1,000,000, 40 cents for each $1; $1,000,000 and less than $3,000,000, 25 cents for each $1; $3,000,000 and upward, 20 cents for each $1.

The amounts thus set aside by the towns, respectively, constitute a joint fund for permanent improvement. After plans and specifications have been approved by the State engineer the governor and council may permit the town to execute the work if it desires to do so; otherwise the work shall be let to the lowest bidder.

The State road funds for trunk lines are provided by State bonds bearing not to exceed 3½ per cent interest. A direct appropriation is made annually for paying interest and installments on the bonds. The regular State aid not on trunk lines is met by current appropriations. The law provides that 65 per cent of the fees and fines from motor vehicles shall be used for maintenance of trunk-line roads and 35 per cent for maintenance of State aid roads not on trunk lines. (Approved by S. Percy Hooker, State superintendent of highways.)

NEW JERSEY

The State highway commission consists of the governor, president of the senate, speaker of the house of assembly, the State treasurer, who serve without compensation, and the commissioner of public roads.

The commission is required to establish a continuous State highway system of improved main traveled roads connecting counties, cities, seaside resorts, large centers of population, outlets at the boundaries of the State, the Ocean Highway, and the Delaware River Drive, and the State commissioner of public roads is directed to submit to the commission a map showing the proposed system, the aggregate mileage of which shall not exceed 1500 miles.

The commissioner of public roads is appointed by the governor for three years. His staff is composed of civil-service employees who hold office, unless removed for cause; a State highway engineer who is chief engineer; and four division engineers, ten regular inspectors and six foremen who are intended to form the nucleus for a trained corps of inspectors. In addition to this force the commissioner may appoint a local supervisor or inspector when necessary on each contract at compensation of $3 per diem.

The State commissioner of public roads is directed to take charge of the construction, improvement, and maintenance of the State highways comprising the State highway system, all such work to be done at the expense of the State, the plans and specifications to be prepared by the State highway department and supervision to be exercised by the department.

The commissioner of public roads is intrusted with the execution of the law granting State aid in the improvement of highways, such highways being in addition to the State highways. The commissioner, after conference with the board of chosen freeholders in respective counties and other local authorities, passes upon requests for aid in road improvement. The surveys, plans, estimates, and specifications are made locally, but must be approved by the State commissioner of public roads before the local authorities advertise for bids. Later the contracts and bonds are examined and approved by the commissioner before work begins. After the work has been completed to the satisfaction of the local authorities a written statement with detailed cost data is submitted to the commissioner, and if after inspection it is approved by him the State's portion of the cost, amounting to 40 per cent, is sent to the county.

After final approval by the State commissioner of public roads such roads shall thereafter be county or municipal roads, to be maintained by the county board of freeholders and the county supervisor or by the township or municipal officers. If the county fails to repair the road within 60 days after notice in writing by the State commissioner, he shall certify such neglect to the State comptroller, who shall withhold payment to the county of any money that may be apportioned to it until such repairs are made. The State road fund includes appropriations made by the legislature and the receipts from motor vehicle licenses and fines.

The commissioner of public roads may grant aid in the construction of bridges on roads being improved to the extent of 20 per cent of their cost, otherwise the State takes no part in the cost of building or maintaining bridges, the only exception being the bridge over the Raritan River to Perth Amboy, for the maintenance of which the State pays one-third in accordance with the terms of a statute passed in 1912. (Approved by Col. E. A. Stevens, State highway commissioner.)

NEW MEXICO

The State highway commission consists of the governor, the commissioner of public lands and the State engineer, all of whom serve without compensation. The commission is required to meet four times a year, in January, March, June and September, and hold such special meetings as they consider necessary. The commission has general supervision of all highways and bridges constructed or maintained wholly or partly by the aid of State money. The commission is required to construct, prepare and maintain at the expense of the State either wholly or in part such public roads as best serve the interest of the general public, looking to the construction and maintenance of a complete system of highways. The commission is directed to investigate the needs of the various localities and to coöperate with the various boards of county commissioners in road construction.

In order to provide State aid fund an annual tax is levied not to exceed 1 mill on each dollar of taxable property, the sum thus realized to be turned over to the State treasurer and constitute the road fund which is subject to the orders of the highway commission.

The commission is required to make an annual report on or before January 1.

The State engineer is the engineer of the highway commission, and subject to its orders, has supervision of the construction and maintenance of all highways and bridges under the State aid act and also has supervision of all county bridges built by contract where the amount exceeds $1000. No bridge costing more than $1000 shall be constructed until the State engineer first approves the site, the contract and specifications.

The commission is authorized to do educational and investigative work.

In extending State aid preference is to be given by the commission to those counties which shall contribute an amount at least equal to that appropriated by the commission.

Certain specific State roads are provided for by State legislation.

The State highway commission is required to appoint in each county a county road board of three members to serve without compensation and to hold office for a period of three years subject to removal by the commission for cause. The county road boards are required to make an annual report to the State highway commission. The county road boards have full charge of road funds in their respective counties. The position of road supervisor was abolished in 1912.

NEW YORK

The State commission of highways consists of a single commissioner who is appointed by the governor with the consent of the senate for a period of five years.

The commissioner of highways appoints a secretary, auditor, and three deputy commissioners. Each of the deputy commissioners has had practical experience in the actual building, construction, and maintenance of highways and is familiar with the operations and effect of State statutes relating to highways and bridges.

The first deputy is a practical civil engineer, whose duties relate to the plans, specifications, and execution of all contracts awarded by the department.

The second deputy's duties relate to the maintenance of State and county highways, and the third deputy's duties relate to the improvement and maintenance of town highways and bridges. The commissioner has general supervision of highways and bridges constructed or maintained in whole or in part by the aid of State money; aids district, county, and town superintendents by advice and information; investigates methods of road construction and maintenance; compiles statistics, including highway map of the State; holds public meetings, etc. The State is divided by the commission into not more than nine divisions, each in charge of a division engineer who, under the direction of the commission, makes surveys, plans, specifications, and estimates for the construction and maintenance of highways in his division constructed wholly or in part by the aid of State money. All State and county highways on which the State expends money are inspected annually and a report prepared showing their condition, the improvements necessary, and the estimated cost, and a report made annually to the legislature setting forth the amount required for maintenance for the ensuing year.

If the board of supervisors of any county fail to appoint a county superintendent of roads, the State highway commission is authorized to appoint such superintendent from the eligible list of the county and fix his salary, or place such county in a district with other counties and appoint a district superintendent. These district and county superintendents are subject to the regulations of the State highway commission. The town superintendent of highways, elected biennially, is also subject to the regulations of the State commission of highways and is required to report annually to the district or county superintendent.

The highways of the State are divided into four classes, namely, State highways, improved and maintained at the sole expense of the State; county highways improved and maintained at the joint expense of the State, county and town; county roads improved and maintained by the county; and town highways improved and maintained by the town with the aid of the State.

The system of State highways is defined by law and the routes described. Such highways are to be improved from the funds from the sale of State bonds. The board of supervisors of any county may request that a certain designated highway be improved as a county or State highway. If the State commission of highways approves the request, it shall cause the division engineer to prepare plans and specifications, which are then sent to the division or county superintendent, who personally examines the highway and makes his recommendation to the commission. The commission may then finally adopt the plans and estimates and, if it be a State highway, advertise for bids and award contracts. If it be a county highway, the plans and estimates are transmitted to the board of supervisors for final approval.

The performance of every contract for State and county highways is under the supervision and control of the State commissioner of highways. When the board of supervisors of a county requests the improvement of a county highway it shall make appropriation of the county's share of the cost of such improvement. After final payment under contract the State commission files a statement of cost with the county treasurer, who thereupon pays upon the request of the commission the county's share as follows: 2 per cent of the cost of each $1000 of assessed valuation of real and personal property in the county for each mile of public highway in such county, not to exceed 35 per cent of the cost for the county. The maintenance of State and county highways is under the direct supervision of the commission, which also has authority to provide for a system of patrol of highways, the patrolman to be appointed by the State commissioner of highways. Each town pays for the maintenance of State and county highways annually $50 for each mile of said highway within the town.

The State annually contributes to the expense of maintenance of county roads which have been constructed without expense to the State 50 per cent of the amount appropriated by the county for the maintenance of such roads.

The State contributes to town highways on the following basis: (1) Where the assessed valuation of the town is less than $5000 for each mile of highway in such town, outside of incorporated villages, an amount equal to the amount of taxes raised for highways; (2) where the assessed valuation is $5000 or over and less than $7000 per mile an amount equal to 90 per cent of such taxes; (3) where the assessed valuation is $7000 or over and less than $9000 per mile an amount equal to 80 per cent of such taxes; (4) $9000 or over and less than $11,000, an amount equal to 70 per cent; (5) $11,000 or over and less than $13,000, an amount equal to 60 per cent; (6) $13,000 or over, an amount equal to 50 per cent. No town shall receive in one year an average of more than $25 per mile for the total mileage of roads outside of incorporated villages, and the amount which is raised by local taxation shall be such as will, when added to the amount received from the State, be not less than $30 for each mile of highway in the town.

A State bond issue of $50,000,000 was authorized in 1906 and an additional State bond issue of $50,000,000 in 1912. The bond issue was originally intended for the improvement of a system of county highways aggregating 8,380 miles, and to this was added a system of State highways aggregating 3,617 miles. The recent $50,000,000 bond issue is to be expended as follows: $20,000,000 for the construction and improvement of State highways and $30,000,000 for the construction and improvement of county highways. The apportionment among the counties is on the basis of population, the measured mileage of public highways outside of cities and villages, and the total area, each factor having a weight of one-third. Direct appropriations are made by the legislature for maintenance. (Approved by R. K. Fuller, secretary, commission of highways.)

NORTH CAROLINA

This State does not make any direct appropriation for highway improvement but the State geological board is authorized to make investigations and give advice concerning highway improvement; and an annual appropriation of $5000 has been made for this purpose.

The legislature of 1913 authorized the working of State convicts on two special highways in the State: one in Henderson County, known as the Hickory Nut Gap Road, 7.2 miles long, of which five miles have been completed; and one in Madison County as a link of the Central Highway, 15 miles long, of which 7 miles have been completed. (Approved by Dr. Joseph Hyde Pratt, State geologist.)

NORTH DAKOTA

At the general election on November 3, 1914, an amendment to the constitution was adopted, providing that the State may grant aid in the construction and improvement of public highways.

The State law provides that inmates of the State penitentiary may be used upon the public highways. However, no convict labor has been used, for the reason that all of the convicts are needed to keep the regular industries of the penitentiary in operation.

The members of the State highway commission, consisting of the governor, the State engineer, and one other member to be appointed by the governor, serve without extra compensation. It is their duty to prepare plans and specifications and superintend the construction of any roads, when requested by any board having jurisdiction over such roads, and to give advice, assistance and supervision with regard to road construction throughout the State, as time and conditions permit, and as the rules and regulations of the commission may prescribe; to have prepared maps of the various counties showing the roads and location of bridges and culverts, and showing roads on which is is proposed to utilize State funds whenever such funds may be available. They shall also issue bulletins containing advice and suggestions, and the law concerning highway construction, from time to time, as they shall deem practicable.

It is the duty of the State engineer, when requested by any board of county commissioners or township supervisors, to prepare plans for the construction of any bridges or culverts, or to examine and report on existing bridges or culverts, charging to the county or township for which such work is done, the actual and necessary expenses and the cost of the work. (Approved by Jay W. Bliss, State engineer.)

OHIO

The State highway commissioner is appointed by the governor, and holds office for four years. He is required to be a competent civil engineer and experienced in construction and maintenance of roads and bridges. He is required to appoint, subject to the approval of the governor, three deputy highway commissioners, no more than one of whom shall be of the same political party as himself, who shall be competent civil engineers and serve during the pleasure of the commissioner. The highway department is required to be divided into three bureaus, i.e., the bureau of construction, the bureau of maintenance and repair, and the bureau of bridges, each to be in charge of a deputy. The State highway commissioner may appoint the following division engineers: Four in the bureau of construction, two in the bureau of maintenance and repair, and two in the bureau of bridges. He may also appoint as many additional division engineers as may become necessary to carry out the provisions of the law.

The State highway commissioner has general supervision over the construction and maintenance of highways and bridges which are constructed or maintained by the aid of State money. He is required to advise with county commissioners and prepare plans, specifications and estimates for local roads when requested to do so by the county commissioners. He shall make inquiries into the methods of road and bridge construction throughout the United States, prepare bulletins, etc. He is authorized to call meetings in each county of the State and give instruction in road and bridge building, maintenance, and repair, and the county commissioners, county engineers, and township road district officers are required to attend, and are paid their regular per diem allowance for the actual time they spend in attending the meetings. He is also authorized to run a car for demonstrating methods of construction and maintenance. The equipment of the Ohio State University may be used by the State highway commissioner in investigating the chemical and physical character of road and bridge material, if the president of the university consents. The State highway commissioner is authorized to maintain inter-county highways, main market roads, bridges, and culverts constructed by the aid of State money, or taken over by the State, and the State may pay the entire cost thereof.

In the granting of State aid for road improvement or inter-county highways, applications are made by county officials to the State highway commissioner and approved or disapproved by him. If he approves the application, he shall cause a map to be made and plans and specifications prepared, including bridges and culverts. He shall then prepare estimates and transmit a copy to the county commissioners. If they approve the construction of the road, they shall so notify the State highway commissioner, and he shall advertise for bids, and subject to the approval of the county commissioners, award the contract to the lowest responsible bidder. Upon the completion of the work the State highway commissioner shall ascertain the cost and apportion the same on the following basis: 50 per cent by the State, 25 per cent by the county, 15 per cent by the township, and 10 per cent by the abutting property owners. The State's share is payable from the unexpended balances remaining to the credit of a county from the money appropriated by the general assembly, or from the State highway improvement fund, provided by an annual levy of three-tenths mill on all the taxable property of the State, first available in 1914. Seventy-five per cent of all money raised by said levy shall be applied to the maintenance of the State highway department and for the construction, improvement, maintenance and repair of an inter-county system of highways in the State. Twenty-five per cent of all moneys raised by said levy shall be used for the construction, improvement, maintenance and repair of certain main market roads in the State, and the same shall be located along and upon the route or portions of said inter-county highways.

The construction, improvement, maintenance and repair of the main market roads may be begun at any point and shall be executed in such manner and method, with such road materials and in accordance with such plans, details and specifications, as may be adopted by the State highway commissioner with the approval of the governor; and as to such main market roads there shall be no necessity for petitions being presented and filed as in other improvements and no procedure for constructions, improvement, maintenance and repairs of roads as is provided for in any other act or acts of the general assembly shall apply to such main market roads.

The highway commissioner shall have power to purchase such equipment and materials and employ such labor as may be deemed necessary to execute with skill and economy any work upon said main market roads without letting contracts for the same at public bidding; and he is further authorized to use convict labor in the building of said main market roads.

For the purpose of providing a fund for the payment of the proportion of the cost and expense to be paid by the county for the construction, improvement, maintenance or repair of State highways, the county commissioners are authorized to levy a tax not exceeding 1 mill upon all taxable property of the county. Said levy shall be in addition to all other levies authorized by law, for county purposes, subject however to the maximum limitation upon the total aggregate amount of all levies in force.

For the purpose of providing a fund for the payment of the proportion of the cost and expense to be paid by the township or townships for construction, improvement, maintenance or repair of State highways, the county commissioners or township trustees are authorized to levy a tax not exceeding 3 mills upon all taxable property of the township or townships in which such road improvement is situated, in whole or in part. Such levies shall be in addition to all other levies authorized by law for township purposes, subject however to the maximum limitation upon the total aggregate amount of all levies in force.

The commissioners of a county may, by a properly certified resolution setting forth that the public interests demand the improvement of a certain highway, described therein, make application to the State highway commissioner for aid from a State appropriation, or from any fund available, for the construction and repair of inter-county highways. Such application must be made prior to January 1, preceding the date when such appropriation becomes available, and shall not include any portion of a highway within the limits of a municipality. If the county commissioners have applied prior to January 1 and upon examination of the application by the State highway commissioner, it is found to be irregular, it shall be his duty to immediately notify the board of county commissioners and request that they make the proper correction or amend the petition and return the same to the office of the State highway commissioner on or before the first of February next succeeding. If the county commissioners have not made use of the apportionment of such county on or before the first day of May next succeeding, then the State highway commissioner shall enter upon and construct, improve, maintain or repair any of the inter-county highways or parts thereof of said county, either by contract, force account, or in such manner as the State highway commissioner may deem for the best interests of the public, paying the full cost and expense thereof from the said apportionment of the appropriation to said county so unused as aforesaid. Any part of the apportionment to a county remaining unexpended shall remain to the credit of such county and be available for the succeeding year as herein provided.

Upon the receipt of an approval of an application from the State highway commissioner, together with proper plans, maps, and specifications, the county commissioners or township trustees may, by a majority vote, adopt a resolution authorizing said highway to be constructed, transmitting a copy of such resolution to the State highway commissioner. If the lines of a proposed highway deviate from those of an existing highway, the officials making application must provide the requisite right of way, and secure proper releases of damages, prior to the commencement of the work.

The county commissioners may, upon the petition of the owners of 25 per cent or more of the lineal feet of adjacent property, order the improvement of a public road, or section thereof, at least one mile in length, or less than 1 mile if it is an extension or connected with a permanently improved street or highway of improved construction. And they may require that the township or townships through which such roads extend shall pay 25 per cent of the cost, excepting bridges and culverts; and that the trustees thereof shall approve the same. The county commissioners by resolution may relieve the township or property owners from any assessment. If more roads are petitioned for than can be constructed in any one year, the State highway commissioner and the county commissioners shall decide upon the road to be first improved, having in mind the importance of such road to the county or township.

No contract for road improvement unless otherwise provided shall be let until the county commissioners shall enter into agreement to assume their share of the cost.

The county commissioners of any county may waive any or all of the apportionment of the expense of highway improvement to be paid by townships or abutting property owners, and assume any part or all of the cost of such road improvement; and the township trustees may, in like manner, waive any or all the apportionment of the expense to be paid by the county or abutting property owners, and assume any part or all of the cost of such road improvement in excess of the amount received from the State. (Approved by James R. Marker, State highway commissioner.)

OKLAHOMA

Under a constitutional amendment the legislature established in 1911 a State department of highways consisting of a State highway commissioner to be appointed by the governor and to hold office for four years. The commissioner is required to have a recognized knowledge of construction and maintenance of improved roads and receives a salary of $2500 and actual travelling expenses.

The commission is authorized to employ an assistant engineer, such clerical force as may be necessary, at an annual expense not to exceed $5000. He is required to make a general highway plan of the State, collect information, prepare standard specifications and plans, and give advice to local officials. The local officials are required to furnish the State highway commissioner with information which he may request. The State highway department is maintained through a fund derived from State automobile license fees, as set forth in the chapter on automobile legislation. State convicts may be used in road work as explained in the chapter on convict labor legislation. (Approved by Sidney Suggs, State highway commissioner.)

OREGON

The 1913 legislature passed a law creating a State highway commission which consists of the governor, secretary of State, and State treasurer. The position of State highway engineer was created, at a salary of three thousand dollars per year, to be appointed by the State highway commission.

The duties of the commission are to determine a system of State roads and to construct the same as money becomes available for that purpose. The highway engineer is required to act in an advisory capacity to the county courts of the different counties in the matter of road construction and maintenance, whenever so requested. On request of the county court of any county, the State engineer must furnish plans and specifications for any piece of proposed road construction, or any bridge, free of all cost to such county. (Approved by H. L. Bowlby, State highway engineer.)

PENNSYLVANIA

The act approved May 31, 1911, known as the Sproul Road Act, provided for the appointment of a State highway commissioner, two deputy State highway commissioners (one of whom must be a competent civil engineer), an auditor, and a chief engineer. These appointments are made by the governor of the Commonwealth by and with the consent of the senate. The State highway commissioner shall appoint an engineer of bridges; 50 superintendents of highways; and 15 competent civil engineers, together with a chief clerk, chief draftsman, assistant draftsmen, and a force of clerks and stenographers.

The State highways commissioner shall cause to be made a survey of all roads of the State and a general highway plan of the State. He shall collect statistics, publish maps giving a complete road survey of each county, and may be consulted by county, city, borough, and township officials. He is directed to construct, improve, and thereafter maintain at the expense of the Commonwealth the highways forming the system of State highways, the specifications for which are to be prepared by the State highway department.

The State highway system, which comprises approximately 8,805 miles, shall be under the exclusive jurisdiction of the State highway department, and shall comprise the main traveled routes between county seats and principal cities, boroughs, and towns, and the main traveled routes leading to the State line.

Where the expense of constructing a route may be materially lessened by a change of location from that at present defined, the State highway commissioner may, with the approval of the governor, change the location of such a route.

Where a toll-road company controls any part of a route forming a State highway, the State highway commissioner may purchase said toll road at a fair and reasonable price, to be approved by the governor.

An appropriation of $2,800,000 was made at the 1913 session of the legislature for the construction, repair and maintenance of the State highways, improved and unimproved, for the two years ending June 1, 1915. Also, at the 1913 session of the legislature, there was a bill passed creating additional State highways, to become effective June 1, 1915, and another bill making changes in the now existing State highways, which became effective the date of approval, July 22, 1913. In addition to the State highway system State aid is granted for the improvement of other roads. Counties, townships, or boroughs (as the case may be) which desire State aid can proceed in the following manner: The township supervisors or commissioners or borough council of the township or borough in which the road lies shall first make petition to the county commissioners, and it shall then be the duty of the county commissioners to adopt a resolution assuming on behalf of the county its share of the cost of the proposed improvement. The county commissioners shall then petition the State highway department for State aid, the cost of the improvement to be pro rated among the townships or boroughs (as the case may be), the county, and the State, the State paying 50 per cent of the cost of reconstruction, the county and township, or borough (as the case may be), the other 50 per cent. If either the county, township, or borough desire to act independently of the other, they may make application direct to the State highway department and agree to assume 50 per cent of the total cost, in which event the other 50 per cent is paid by the State. The State also pays 50 per cent of the cost of maintenance, the other 50 per cent being paid by the township or borough in which the road may lie.

The State aid fund is apportioned among the several counties of the State according to the mileage of township and county roads. An appropriation was made at the legislative session of 1913 for the two years ending June 1, 1915, of $1,400,000, covering the permanent improvement and maintenance of State aid roads. (Approved by S. D. Foster, chief engineer.)

RHODE ISLAND

The State board of public roads, consisting of five persons, one from each county, is appointed by the governor for a term of five years. The board has direct control of the expenditure of all appropriations by the legislature for road improvement, and has supervision over the construction and maintenance of all State roads.

The entire cost of construction and maintenance of State roads is paid by the State. At the close of 1912 there were 294 miles of State roads under the direct control of the State board. A State bond issue of $600,000 was authorized in 1906 to bear 3 per cent and an additional bond issue of $600,000 in 1909, the proceeds to be used in completing the system of State roads. No more than one-third nor less than one-seventh of the available appropriation in any year shall be expended in any one county. The proceeds of automobile licenses and fines are used for the repair of State roads under the direction of the State board of public roads.

In addition to the State highways, State aid is granted as follows:

Whenever any town shall make an annual appropriation equal to or in addition to the sum of 20 cents on each $100 of taxable valuation, and whenever the electors shall vote that said appropriation be expended under the direction of the State board of public roads a sum of money equal to one-fifth of the moneys so appropriated by any town is annually appropriated by the State for the care and maintenance of the public highways and bridges of said towns.

In 1912 legislation was enacted providing that bridges on State roads shall be under the control of the State board of public roads. (Approved by Peter J. Lannon, clerk, State board of public roads.)

SOUTH CAROLINA

The State does not grant aid and has no highway department but considerable amount of efficient investigative and educational work is done in behalf of road improvement by the State commissioner of agriculture, Hon. E. J. Watson.

SOUTH DAKOTA

A State highway department was established in July, 1913, consisting of a commission of three members, without salary. There is no provision in the road laws of the State for State aid or control of the highways, no funds being provided. The work of the commission is to give advice and conduct educational work.

TENNESSEE

The State has no highway department and grants no aid to road improvement.

TEXAS

The State has no highway department and grants no aid to road improvement.

UTAH

The State road commission consists of the governor, the State engineer, the State treasurer, one member of the faculty of the Agricultural College of Utah and one member of the faculty of the University of Utah all of whom serve without compensation. The commission selects and designates the roads which comprise the system of State roads; has charge of the expenditure of the State road building fund; furnishes plans, specifications and estimates on application of the county commissioners; prepares and issues a manual of road building for public officials; gives information to local officials; submits report biennially to the governor.

An appropriation is made from the general revenues of the State for the construction of State roads such appropriation to be expended equally in each county. The law requires counties having an assessed valuation under $2,000,000 to duplicate one-fourth of the amount of the State road fund appropriated by the State for said county, and counties having an assessed valuation of more than $2,000,000 and less than $4,000,000, duplicate one-half of the amount, and counties having an assessed valuation of more than $4,000,000 duplicate the full amount. Should the county default in the payment of its proportion, the State road commission is authorized to collect the amount of default from any moneys due said county in the hands of the State treasurer. Whenever the State road commission decides to improve a portion of the road in any county the county commissioners are required to levy a special road tax not to exceed 5 mills on all taxable property within the precinct, the amount thus realized to be used in connection with the county appropriation and the State road building fund but not in lieu of the amount to be appropriated by the county.

The State highway commission makes all plans, specifications, and estimates for the improvement of State roads, and awards contracts. The State roads in each county are to be kept in repair by the county.

State bonds are authorized under an act passed in 1911 in the sum of $260,000 to be expended by the State highway commission. The provisions of this act are explained in the chapter on bond issue legislation. The proceeds from motor vehicle fees are also applied to the State road fund. State convicts may be worked upon the State roads. Approved by E. R. Morgan, State Highway Engineer.

VERMONT

The State highway commissioner is appointed by the governor for a term of two years, and has control over the expenditures of all moneys appropriated by the State for highway purposes. He shall annually allot the same to the town road commissioners, and furnish plans, specifications, and advice. He appoints not to exceed one supervisor for each county to assist him in the performance of his duties. The State highway commissioner meets the road and street commissioners of the several towns and villages at least once annually, and these commissioners receive their per diem and necessary expenses for attending the meetings.

The selectmen and town commissioners select the roads on which State aid shall be expended, but such selection is subject to the approval of the State highway commissioner. The selectmen and the State highway commissioner may agree upon any plan of expenditure deemed best in any such town.

A State highway tax of 5 cents on each $100 is annually assessed and the amount thus derived is apportioned to the towns upon the basis of the road mileage therein, which shall be certified to the State treasurer by the selectmen. A direct appropriation is made to be available to cities and towns, excepting incorporated villages, as follows: When a town shall vote to raise money in addition to the amount required by law, an amount shall be apportioned to the town equal to the excess amount, provided it is not less than $100 or more than $1000 in any one year.

Automobile fees are used for the repair of main highways under the direction of the State highway commissioner.

VIRGINIA

A State highway commissioner is appointed by the governor, with the consent of the general assembly, for a term of six years. The commissioner, together with the professors of civil engineering of the University of Virginia, the Virginia Military Institute, and the Virginia Polytechnic Institute, constitute the State highway commission. The State highway commissioner is required to be a citizen of the State and a civil engineer versed in road building.

The State highway commissioner has supervision of the construction and maintenance of main-traveled roads of the State, may recommend to the governor and local authorities needed improvements, collect information and disseminate the same, and give advice.

Whenever the local authorities of any county desire to permanently improve any main road, they may make application to the State highway commissioner, If he approve such application he shall prepare plans, specifications, and estimates and submit a copy of same to the local authorities. If they decide to improve said road, they may make application to the State commissioner for State aid, which may be money aid or convict labor. If money aid is desired, the local authorities shall agree that the county will bear one-half of the cost of improvement and the State highway commissioner shall advertise for bids and the local authorities award the contract subject to the approval of the State highway commissioner. The work shall be done under his supervision. The money aid is apportioned among the counties of the State according to the total amount of State taxes paid by the respective counties. If a county pays more than 50 per cent of the expense it shall be entitled to receive annual apportionment until the receipts from the State shall equal 50 per cent of the cost of such permanent improvement.

If convict labor is desired, the local authorities shall undertake to supply necessary materials, tools, and teams, and have the work done under the supervision of a civil engineer, to be supplied by the State highway commissioner, at a salary not to exceed $1200 a year, to be paid by the county. The State commissioner then makes requisition on the superintendent of the penitentiary for such convicts as he may deem necessary. If the local authorities desire to do the work by contract, the labor of the convicts may be estimated at $1 per 10 hour day, and the State grant in this way not more than 40 per cent of the contract price. Counties may not receive both convict labor and money aid in the same year. Any county may use its apportionment of State money in the construction of bridges, and any county may determine what part of its 50 per cent of the cost of road or bridge construction shall be borne by the sub-divisions of the county.

Whenever any county or district shall issue bonds for road improvement, application shall be made to the State highway commissioner for a competent highway engineer to make plans and specifications and supervise the work, which shall be awarded to contract jointly by the State highway commissioner and the local authorities. The proceeds of automobile fees are expended under the direction of the State highway commissioner. (Approved by G. P. Coleman, commissioner, State highway commission.)

WASHINGTON

The State highway board consists of the governor, the auditor, the State treasurer, the State highway commissioner, and a member of the State railroad commission, to be named by the governor. The State highway commissioner, who is appointed by the governor for a term of four years, is required to compile statistics relating to public highways throughout the State, give advice to local officials, make recommendations as to needed State highways, with estimated cost. The State highway board shall apportion the amount appropriated for any State road to be expended within the boundaries of the several counties through which the road may pass.

The permanent highway law provides for a tax of 1¼ mill on all property in the State, the amounts received from each county to be credited to the county paying the same until it shall be expended on contract for permanent highways in such county, not less than 15 per cent of the cost of such permanent highway to be assessed on abutting property and the balance to be paid from the permanent highway fund. When a road is completed under this act, the highway commissioner is required to inspect it and certify to the State auditor that the work has been done in accordance with plans and specifications which were provided by him before the contractor can be paid the final 20 per cent on the contract. The legislature makes specific appropriations for specifically designated roads from time to time.

The State highway board is authorized to establish State quarries to be operated by convict labor. The material prepared at the State quarries shall be delivered to the State highway commissioner for use on State roads, or to any county, city, or town after the requirements of State roads work are met, at a price not less than 10 per cent above the estimated cost of production at place of delivery. Any surplus material may be sold. The State highway commission is authorized to appoint a superintendent of quarries. The State convicts may be used under the authority of the State board of control, in the building of State roads.

WEST VIRGINIA

At the 1913 session of the legislature a law was enacted establishing a State road bureau consisting of the professor in charge of the railway and highway department of the State university to be chief road engineer and chairman of the bureau; the director of the State experiment station and two additional members to be appointed by the governor. Both of these two members shall not be appointed from the same political party. The professor in charge of the railway and highway department at the State university is to be appointed by the governor. The bureau is to give instruction and advice in road building, collect data, test materials, and have such supervision of the roads of the State as is consistent with the constitutional provision on this subject and to see that all road laws are enforced.

The State grants aid to the counties in the form of convict labor to be employed under the supervision and in accordance with the plans and specifications of the State road bureau.

The bureau is under the control of the governor.

The law requires all county prisoners to work on the roads, all justices to sentence the misdemeanor convicts to work on the road their sentence and also the fines and costs if not otherwise paid.

Prisoners not able to give bail or refused bail while awaiting trial may elect to work on the roads and if convicted get credit for the work done and if acquitted on the charge the county shall pay them 50 cents per day for the days worked.

The road bureau is stationed at the University and a highway laboratory has been established preparatory to testing road materials.

A special course in highway engineering has been provided. The law requires all county road engineers to attend this course for at least 10 days in each year. (Approved by A. D. Williams, chief road engineer.)

WISCONSIN

The State highway commission consists of five members, who are nonpaid except as to actual expenses. The dean of the college of engineering of the State University and the State geologist are members ex officio. The three other members are appointed by the governor. The commission in turn selects a State highway engineer.

The boards of county commissioners are required to select a continuous system of roads, to be known as "the county system of prospective State highways." These roads may be constructed by the town, county, and State jointly, each paying one-third of the cost, or a county can assume two-thirds of the cost and the State one-third. Bridges over 6 feet in span are paid for, two-fifths each by the town and county and one-fifth by the State. Improvements on this road system are made by a county highway commissioner selected by the county board under the general direction and in accordance with the plans and specifications of the State highway commission. After improvement, the hard-surfaced roads are maintained by the counties and the dirt roads by the towns. (Approved by William Dawson, chief clerk, highway commission.)

WYOMING

Certain highways have been designated as a system of public highways to be improved by State convicts, under the control of the State commission of prison labor. All locations and surveys of such highways are to be made under the direction of the State engineer, while the county commissioners are required to secure rights of way and construct bridges in connection with plans made by the State engineer. An appropriation of $10,000 was made by the eleventh legislature to purchase the necessary equipment and meet expenses incident to utilizing convicts on this work.

An additional appropriation of $7500 was made by the last (twelfth) legislature for the purchase of additional tools and equipment. (Approved by A. J. Parshall, State engineer.)

LOCAL ROAD LEGISLATION

County Systems

In each of the States of Alabama, Colorado, Florida, Georgia, Idaho, Indiana, Kansas, Maryland, Minnesota, Montana, Nevada, Oklahoma, Pennsylvania, South Carolina, Utah, Washington and Wyoming the jurisdiction over roads vests in a board of county commissioners elected by the people. The duties and authority of the boards of county commissioners are similar in most of these States.

In Alabama the board consists of the probate judge and four other commissioners, but, by special statute, boards of revenue or other like boards may be created to take the place of the county board of commissioners. In Alabama the board of county commissioners may appoint a supervisor of roads for an entire county. On petition of a majority of the electors of a county, the board of county commissioners in Colorado may divide the county into districts, name a board of directors, consisting of three members for each district, and appoint a superintendent of roads for the county. In Indiana the county board of commissioners has general supervision over the roads of the county while the township trustees have jurisdiction over the township roads. The county board of commissioners has authority over State and county roads in Kansas and may appoint a county engineer or designate the county surveyor as county engineer to have general supervision of all county road and bridge work under the authority of the board. Competent civil engineers may be employed by the county board in Maryland for the construction and maintenance of roads and bridges. The county board may appoint a county superintendent of highways in North Dakota, while in Ohio the county surveyor has control of road work under the county board. Each township in Pennsylvania elects three supervisors of roads, one annually, who shall have jurisdiction over all township road matters. The county supervisor has charge of the roads under the direction of the county commissioners in South Carolina. In Utah the county board is required to appoint a county road commissioner biennially. In Washington the county board of commissioners appoints a supervisor for each district and a county engineer is elected by the people every two years. The voters of each county may elect a county supervisor for a term of two years in Wyoming. In Oklahoma the general jurisdiction over roads vests in the board of county commissioners, with immediate supervision in the respective townships resting with the township trustees, who divide the township into convenient road districts with a road overseer to be elected biennially for each district. In the other States mentioned above the county commissioners follow the old plan of dividing the county into suitable precincts or districts and appointing one or more overseers for each, this practice being varied in a few of the States by having the overseers elective instead of appointive.

Jurisdiction and control over the public roads in the States of Arizona, California, Iowa, Mississippi, and Virginia vests in a county board of supervisors. On January 1, 1915, a new law became effective in Arizona providing that the board of supervisors appoint a county road engineer at not to exceed $3000 per year salary. In Iowa there is a distinction between county and township road work, the former being under the county board and the latter under the board of township trustees. One supervisor is elected from each district or beat in Mississippi and has control of the roads in his district or beat and may appoint a road overseer therefor. Each county is divided into five districts or beats and the five supervisors comprise the county board. The board of supervisors of each county in Virginia is authorized by law to appoint a county superintendent of roads, or, at their discretion, to appoint a superintendent of roads for each magisterial district, or group of districts, or they may appoint both a district superintendent and a county superintendent of roads.

In New Jersey the board of chosen freeholders is the governing board of the county and has charge of all county roads and appoints the county supervisor of roads, who is required to report to the board. The board of chosen freeholders may also appoint a county road engineer.

In Arkansas, Delaware, Kentucky, Missouri, Oregon, Tennessee, Texas, and West Virginia jurisdiction over the roads vest in the county court. This court in Delaware is called the levy court, in Kentucky the fiscal court, and in Oregon and Texas the county court or commissioners court. In Arkansas the probate judge is the chairman of the county court and road officials are appointed by him. In Kentucky the county judge with the consent of the fiscal court of the county appoints the county road engineer, but the person appointed must have first passed an examination held for that purpose by the State commissioner of public roads. The chairman of the county court in Oregon and Tennessee is the county judge, who in the State of Tennessee, with the full county court, consisting of four other members, divides the county into road districts and appoints a road commissioner for each district. The road commissioner so appointed appoints road overseers for each section of the road in his distrct. In Tennessee the county court also appoints a board of turnpike commissioners, who looks after toll roads in the county. Some of the counties in Texas have a county judge as chairman of the county court, who appoints a county engineer or superintendent, but in a number of counties the commissioners court appoints county road superintendents or engineers. In Delaware the levy court appoints the county road engineer.

Louisiana is divided into parishes instead of counties. The police jury is the governing board in each parish and corresponds to the county board of commissioners, the county board of supervisors, or the county courts in other States.

County and Township Systems

Another group of States, comprising Illinois, Michigan, North Carolina, North Dakota, Ohio, South Dakota, and Wisconsin have both county and township systems, some of the counties operating under one and some under the other. In Illinois the county board of commissioners of each county is required to submit to the State highway commission a list of from three to five persons from which list the State highway commission establishes, by competitive examination, an eligible list for county superintendent of highways, and the county board appoints the county superintendent of highways from the list so established. The term of office of the county superintendent of highways is six years and he is subject to the regulations of the State highway commission, but may be removed by the county board for incompetency or neglect of duty. In counties not under township organization, the county board divides the county into road districts. In each township in counties under township organization and in each road district in counties not under township organization there is a board of highway commissioners of three members, each serving for three years, the terms being so arranged that one expires each year. These township or district boards have general control of the roads within their township or district. In Michigan, commissioners of highway in each township have charge of construction and maintenance of township roads, while the county board of supervisors has jurisdiction over county roads. The board of supervisors of any county may submit to the electors thereof the question of adopting the "county road system," and, if it is adopted, a board of county road commissioners, consisting of three members, shall be elected by the people of the county to have jurisdiction of all road matters therein. Missouri operates under both a county and a township system. The principal governing board of the counties is the county court, composed of three members. This court annually appoints a county highway engineer and fixes his salary. There are 112 counties in the State, in 92 of which a county court has full charge of road affairs and divides each county into roads districts and appoints overseers in addition to appointing the county highway engineer, and in 20 of the counties the roads are controlled by the respective townships, the governing body of each being a board of township commissioners The county and township system also exists in Nebraska. In those counties having the county system the county commissioners appoint a county highway commissioner in January of each year, and in those counties under township organization the county commissioners divide the county into supervisor districts, in each of which the people elect a road supervisor. Some of the counties of North Carolina operate under the county system and some under the township system, but most of the counties operate under special laws. Most of the counties of Oklahoma operate under the township system in which a township board of trustees has charge of the roads and appoints a road supervisor for each road district of the township. In counties operating under the county system in Oklahoma, the board of county commissioners, elected by the people, may appoint a county highway engineer. In Wisconsin general jurisdiction of the roads is in the hands of the township boards, consisting of three members elected annually, but the county boards are authorized to vote on the method of paying road taxes.

The States of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont have the town system of government as contrasted with the county system so general in most of the other States. The governing body in each of the towns is known as the board of selectmen, usually consisting of three members, elected at the annual town meeting, except in the State of Rhode Island where the governing body is known as the town council. The selectmen usually employ a road agent or highway commisioner, but in many instances this latter official is elected by the people instead of being appointed by the board of selectmen. Some measure of jurisdiction over roads vests in the county board of commissioners, as for instance in Maine where the county boards have authority over county roads and over town roads in unincorporated towns and in New Hampshire where they have jurisdiction over county roads. In Connecticut, if the town or selectmen refuse or neglect to repair the roads, then the board of county commissioners may order the repairs made when petitioned in writing so to do. In Vermont the selectmen of each town appoint a road commissioner for the town and the road commissioners so appointed constitute the county board of road commissioners. In most of these States the county boards have some authority in the matter of laying out new roads and in the alteration or discontinuance of roads from town to town.

Centralized Systems

New York has a rather centralized system in that the State highway commission, by reason of its extending aid to counties and townships, exercises a limited supervision over practically the entire road mileage of the State. In the counties the governing body is the board of supervisors, and in the townships the township board. The county superintendent of roads is appointed by the county board of supervisors, but in the event they fail to make such appointment, then the State highway commission makes the appointment or includes the county in a district and appoints a district superintendent. The term of office of the superintendent is four years, but he may be removed by the State highway commission upon written charges. Such superintendent is subject to the rules and regulations of the State highway commission. The towns elect annually a town superintendent of highways who has supervision of the highways therein, subject to the regulations of the State highway commission. The State grants aid in the construction and maintenance of practically every type of road in the State, and the various road officials conduct their work in accordance with the regulations prescribed by the State highway commission. The New York system is, therefore, highly centralized.

In 1912 an act was passed in New Mexico creating a county road board in each county to serve without compensation and to consist of three members, to be appointed by the State highway commission for a period of three years and to be subject to removal by the commission for cause. The county road boards are required by law to make an annual report to the State highway commission. The New Mexico system appears to be even more centralized than the New York system in so far as the legislation is concerned, but will probably prove much more local in its actual operation, as the county road boards, for the most part, expend only local funds and are therefore not as constantly in touch with the State highway officials as are the local officials of New York through the expenditure of State funds.

In Iowa the State highway commission is given by law general supervision over all road work in the State, while in Illinois the county road superintendents are by law made deputies to the State highway engineer and are vested with the power to veto expenditures in excess of $200 in townships and road districts.

Local Revenues and Labor Taxes

The system of working out road taxes has been abolished by a great many States in recent years but is still in effect in the States of Alabama, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nevada, New Mexico, North Carolina, Oklahoma, South Carolina, South Dakota (partially), Tennessee, Texas, Washington (partially), Wisconsin (partially), a total of 21 States. In the remaining 27 States the taxes are paid in cash, some of the States levying a cash poll tax as well as property tax and some restricting the taxation to property.

In some of the States the formation of special assessment districts for the construction of roads is permitted by law.

In Arkansas the law provides that such improvement districts may be formed upon petition of a majority of the property owners. The cost of the improvement is assessed upon the property owners in the district and the work is done under the direction of a board of directors composed of three members who receive $3 per diem for days actually employed. In Arizona the law provides such districts not to exceed 10 miles in length and 1 mile in width and permits bonds to be issued by a vote of the electors. In Florida special road and bridge districts may be created by election but the special taxes are levied and collected by the county board. Among other States which permit this system are Illinois, Indiana, Mississippi, Missouri, Montana, and Oklahoma.

Wide Tire Legislation

Wide tire legislation is in effect in 17 States but has proven rather ineffective owing to a lack of enforcement. In the States of Arizona, California, Delaware, and Florida provisions of law in regard to the width of tires are operative only when adopted by the local or county road officials. In Idaho the law is operative unless suspended by resolution of the board of county commissioners, and in Vermont the selectmen may give a person permission to use vehicles with tires of less width than that prescribed by law when the highways will not be greatly impaired thereby. The States of Delaware, Iowa, New Hampshire, and Pennsylvania grant a rebate of from one-fourth to three-fourths of the property road taxes to those complying with the provisions of the law relative to width of tires on vehicles, and in Pennsylvania, in addition to the one-fourth rebate of the property taxes, a rebate of not to exceed five days of labor taxes may be granted. In South Carolina all vehicles, the tires of which are more than four inches broad, are subject to a toll on all toll roads in the State less by 25 per cent than such vehicles of the same description having narrower tires.

LEGISLATION GOVERNING LOCAL BOND ISSUES[1]

Alabama

The court of county commissioners and board of revenue of any county may order an election on the question of issuing bonds of the county for building roads or to pay debts created for the building of roads. After an election is held, another such election shall not be held within one year. A majority vote is necessary to carry. The amount of bonds shall not exceed 3½ per cent of the assessed value of property and shall bear not to exceed 5 per cent interest, shall be sold for not less than par value, and shall run for such time as may be fixed by the court of county commissioners and board of revenue. No specific provision is made by law for retiring such bonds, and this matter presumably is left to the discretion of the court of county commissioners and board of revenue

Arizona

The board of trustees of any road district may, when it is deemed necessary or advisable to expend a larger amount than can be raised by the tax of 75 cents, call an election and submit the question of bonds to the voters of the district. A two-thirds favorable vote authorizes the issuance and sale of bonds, which shall run for not more than twenty years, shall bear interest not exceeding 6 per cent, payable annually, and shall not be sold for less than par. The board of supervisors shall levy a tax sufficient to pay interest and retire bonds at the end of their term, although the board may provide for bonds to be retired serially.

Arkansas

Highway improvement districts may be organized and chartered upon vote of a majority of the electors. If so provided in the charter, the State highway commission, as agent of any such highway improvement district, or such other commissioners as may be designated as such agents in the charter, may issue bonds for terms not exceeding thirty years, with interest at not exceeding 6 per cent per annum. Bonds may be serial or straight terminable bonds with proper provision for a sinking fund. Such bonds shall be a lien upon all real estate in the district, and an annual tax shall be levied to pay interest and principal. No bonds shall be sold for less than par.

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[1] From data supplied by U. S. Office of Public Roads.

California

Upon petition of a number of freeholder electors of any county equal to 10 per cent of the last vote cast for governor, praying that the issuance of bonds for highway purposes be submitted to the electors, the county supervisors may appoint a highway commission of three members for such county to investigate the main roads and report to the board of supervisors those roads that should be improved, their estimated cost and the amount of bonds to be issued. If this report is approved by the board of supervisors, an election on the issuance of the bonds shall immediately be called. A two-thirds majority vote of the qualified electors is required. The term and rate of interest is not specified in the act. All work done with the proceeds of the bond issue shall be under the direction of the highway commission.

The county supervisors of any county may create road districts under two different acts. *A permanent road district* (act of March 19, 1907) may be created upon the petition of a majority of the land owners of the proposed district, who may, in their petition, propose a bond issue for certain road improvements, and this bond issue shall be submitted by the supervisors to the electors of the district, and if two-thirds of the votes cast are favorable, then bonds of the district shall be issued not to exceed 15 per cent of the assessed valuation, to run not to exceed twenty years, and to bear interest at not to exceed 7 per cent per annum. The bonds shall be sold to the highest bidder at not less than par, and the work authorized shall be done by contract to be let to the lowest responsible bidder. *A special road district* (act of March 21, 1913), for certain specified improvements on established roads may be created by the county supervisors after giving notice of the proposal, if a majoroity of the land owners of the proposed district do not file objections thereto prior to the date set for hearing objections. Upon the creation of the district, contracts under the approved specifications shall be awarded to the lowest responsible bidder and, upon the completion and acceptance of the work, bonds of the district shall be issued to pay for this work, to run not to exceed twenty years, and bear interest at not to exceed 7 per cent per annum. Under both acts a tax shall be levied to pay interest and principal when due, although in the case of bonds issued by a special road district the county supervisors may make tranfers of funds for the payment of interest and principal when due.

Colorado

When the county commissioners of any county shall deem it necessary to create a county indebtedness for road and bridge purposes, they may submit the proposition to a vote and, if a majority of the votes cast are in favor of the proposition, they may issue bonds of the county in the aggregate not to exceed the following: Counties of assessed valuation over $1,000,000 and less than $5,000,000. $2 on each $1000; and counties of assessed valuation over $5,000,000, $6 on each $1000. These bonds shall bear interest not exceeding 10 per cent per annum and shall be payable at the pleasure of the county after ten years, but absolutely due and payable twenty years from the date of issue. To pay the interest on such bonds, an annual tax shall be levied by the county commissioners, and for their ultimate redemption the county commissioners shall levy annually, after ten years, a tax upon all taxable property in the county in such an amount as to create a yearly fund equal to 10 per cent of the whole amount of the bonds. The proceeds of these bonds shall be used only for the purpose for which they were issued.

Connecticut

No general road bonding law.

Delaware

No general road bonding law.

Florida

Upon a petition of 25 per cent or more of the registered voters or freeholders residing in any territory embraced wholly or in part in one or more road districts, praying that this territory shall constitute a special road and bridge district for the purpose of improving roads and bridges therein by the levy and collection of special road and bridge taxes or by the issue and sale of bonds, the board of county commissioners shall order an election thereon, and a favorable majority vote shall be necessary to authorize this arrangement. If, at this election, bonds are authorized to pay for such improvement, the board of county commissioners shall issue and sell these bonds and levy an annual tax to pay the interest and create a sinking fund for their redemption.

Georgia

No general road bonding law.

Idaho

There are in Idaho two classes of road districts that are authorized by law and may issue bonds. Since 1905 it has been lawful for any portion of a county containing twenty-five or more resident taxpayers, by a majority vote of the resident freeholders at an election ordered by the county board of commissioners and petitioned for by a majority of the freeholders, to organize and become a good roads district. Three good roads commissioners are also chosen at this election, who are authorized, with the consent of two-thirds of the qualified freeholders expressed at an election, to issue bonds in any amount not exceeding 25 per cent of the assessed real property valuation in the district, and the proceeds must be used exclusively for road purposes. These bonds shall bear interest not to exceed 6 per cent, shall run for not more than twenty years, and shall not be sold for less than par.

Under an act of 1911, fifty or more freeholders of lands wholly within a county aggregating 20,000 acres or consisting of less contiguous territory that has an assessed valuation of $1,000,000, provided that these freeholders own at least 10 per cent of all the property in the proposed district, or a number of resident freeholders equal to 20 per cent of the last vote cast for governor may petition the county board of commissioners for an election at which the majority vote decides. If the vote is favorable, a highway district is organized with three highway commissioners, with terms of four years each, and the first of these commissioners are appointed by the governor, while their successors are elected. The commissioners constitute a highway board and have authority by resolution to issue coupon bonds for road purposes at not exceeding 6 per cent interest, and payable within twenty years by sinking fund provided therefor. If these bonds increase the outstanding bonded debt of the district, the resolution shall provide for an election, and a two-third vote is necessary to carry the election. In highway districts the amount of the bond issue shall not exceed 10 per cent of the assessed valuation of all property in the district.

A good roads district may become a highway district in the same manner as any unorganized territory.

Illinois

If the highway commissioners in any township in a county under township organization or in any district in a county not under township organization desire to expend on any bridge or other distinct and expensive work on the roads a greater sum than is available, they may call a special election to decide on the issuance of bonds. If a majority of the legal voters voting at such election shall favor the bond issue, the commissioners and town clerk or district clerk shall issue from time to time, as the work progresses, a sufficient amount of bonds for the purpose of building the bridge or other construction. These bonds shall bear not to exceed 5 per cent interest and shall be of such denominations and upon such time as the necessities require. They shall not be sold for less than par and the town or district must provide for their payment by appropriate taxation. Likewise, a petition signed by the highway commissioners and one hundred freeholders may be addressed to the town clerk requesting an election to determine whether the town shall borrow funds to construct or maintain gravel, macadam, or other roads. A majority vote shall cause the bonds to be issued under the same provisions as above: Provided that the amount to be voted upon, including principal and interest, shall not exceed the amount which can be raised during a period of five years by an annual levy of $1 on each $100 of taxable property.

Indiana

County commissioners are authorized, when requested by a petition signed by fifty freeholders, to grade, drain and pave with "stone, gravel or other road paving material" new or existing highways in any township or on the line dividing two or more townships, and to issue 5 per cent county bonds not to exceed the contract price of the improvements, nor in excess of 4 per cent of the assessed valuation of the town or townships including bonds already issued. The bonds must be in denominations not less than $50 and payable in semiannual series in not less than ten nor more than twenty years. The bonds are retired by an annual tax levied by the commissioners on all the property of the townships affected. Complete plans and specifications for all improvements are made before the election is ordered by a competent civil engineer and two viewers appointed by the commissioners.

For the same purposes as above, gravel road assessment bonds may be issued by county commissioners when petitioned by a majority of the resident landowners within one mile of the proposed improvement. The bonds are paid off by assessment upon the property in proportion to the benefits derived from the improvement.

For the purchase of toll roads, the county commissioners may issue bonds not exceeding 4 per cent of the payable assessed valuation in annual series for not more than twenty years, and bearing interest not exceeding 6 per cent.

All highway bonds bearing interest not exceeding 4½ per cent are exempt from taxation.

Iowa

No general road bonding law.

Kansas

Upon petition of 60 per cent of the landowners who own at least 50 per cent of the land to be taxed, naming the road, the terminal points of improvement, the kind of improvement, and the number of assessments, not exceeding ten, to be made in payment thereof, the county board shall improve this road if it is found and declared to be of public utility.

The county commissioners are empowered to make contracts. In payment for any work or material, these commissioners shall issue special improvement bonds, bearing interest not exceeding 6 per cent and payable within the time or times mentioned in the petition.

Three-fourths of the cost of the improvement shall be apportioned among the property owners within the radius described in the petition and shall be collected as other taxes. One-fourth shall be charged to the township or townships in which the improvement is made and this amount shall be raised in the same manner as provided by law for raising taxes for all purposes: Provided that this act does not apply to the construction or improvement of roads costing less than $500 per mile.

Bridge bonds in any sum not in excess of 1 per cent of the taxable property may be issued by the board of county commissioners of any county, the mayor and council of any city, and the trustee, clerk, and treasurer of any township, upon a majority vote at an election called by a petition signed by two-fifths of the voters of their respective political division.

The bonds shall be in denominations of not less than $100, shall bear interest not exceeding 10 per cent, and shall run for not less than five, nor more than thirty years.

Kentucky

On the petition of 150 voters and freeholders of a county, the county court shall call an election to determine whether bonds of the county shall be issued in an amount not to exceed 2 per cent of the taxable valuation of the county. If two-thirds of the legal voters voting shall favor the issuance of bonds, the fiscal court may issue them, to bear not exceeding 5 per cent interest, to run not less than five nor more than thirty years, and to be sold for not less than par. The fiscal court shall levy an annual tax of not to exceed 30 cents on each $100 valuation of taxable property in the county, to pay the interest on such bonds, and to create a sinking fund for their redemption at maturity. Sinking fund accumulations may be loaned by the fiscal court on first mortgage real estate security, on the basis of 50 per cent of its value.

Any county which issues bonds and expends the proceeds thereof for building public roads, under the direction of the commissioner of public roads, in an amount greater than the amount which said county may be able to secure by apportionment from the State road fund for that year, shall be entitled to receive from the State road fund in subsequent years such further amounts or apportionments as will make the total amount ultimately received from said fund equal to one-half the amount so expended by said county.

Louisiana

Municipal corporations. drainage districts, or parishes may issue bonds for the purpose of improving the roads therein. Before these bonds are issued, the question shall be submitted to an election and a majority in number and in the amount of property valuation of the actual votes cast shall be necessary to carry the election. Bonds shall not be issued for a greater amount than 10 per cent of the assessed valuation, shall bear not exceeding 5 per cent interest, and shall run not to exceed forty years. A sinking fund shall be provided to redeem these bonds at maturity and an annual tax imposed to create this sinking fund and pay the interest on the bonds annually. Such bonds shall be sold for not less than par, and the proceeds thereof shall not be used for any other purpose than that for which they are issued.

Police juries of the several parishes are authorized to divide their respective parishes into road or sub-road districts, and the governing authorities of said districts shall have the right to issue bonds, in accordance with the general laws of the State authorizing the issuance of road bonds, to provide for the construction of the public roads therein.

Maine

No general road bonding law.

Maryland

No general road bonding law.

Massachusetts

No general road bonding law.

Michigan

The township board of any organized township, upon petition of at least twenty-five freeholders thereof, may submit to an election the proposition of issuing bonds of the township in an amount not exceeding 5 per cent of the assessed valuation thereof, for improving the roads therein under the commissioner of highways, subject to direction of the township board a majority of the legal voters voting is necessary to authorize the bond issue. These bonds shall bear not to exceed 5 per cent interest and shall run not to exceed twenty-five years, and a tax shall be levied annually to meet the interest and principal as fast as they become due.

Counties that have adopted the county road system may issue bonds to pay for such improvements as the commissioners of highways decide to make, in an amount not exceeding 3 per cent of the valuation of property assessable for this purpose. Before issuing these bonds, the county board of supervisors must order an election to decide on the issue upon petition signed by twenty-five resident freeholders. A majority of votes cast is required to authorize the bond issue. Bonds shall not be sold for less than par and shall run for not exceeding twenty years. The rate of interest and method of payment are not specified.

The county board of supervisors in counties that have not adopted the county road system may, without petition from freeholders, submit to a vote the question of issuing bonds of the county for road purposes.

Minnesota

On petition of 50 or more voters who are freeholders of the county, the county commissioners may submit to vote the proposition of issuing county bonds for road purposes. If a majority of those voting are in favor of the proposition, the county board shall issue bonds of the county in such amount as will not, with existing indebtedness, make the total indebtedness of the county exceed 15 per cent of the assessed valuation of taxable real property therein. These bonds shall bear not to exceed 6 per cent interest, shall have coupons attached, and shall be paid in equal installments—the first to become due and payable not less than five years after the date thereof, and the last not more than twenty years after such date.

The town board, to make extraordinary improvements that will cost more than the town is otherwise authorized to appropriate, on petition of 15 or more voters of the town owning real estate therein, may submit the question of the improvement to the next annual town meeting, or, if so requested, may call a special town meeting to vote on the question, and a 60 per cent majority vote shall authorize the improvement. The town board may then issue bonds of the town to raise the necessary funds. The amount of these bonds, with the existing indebtedness of the town, shall not exceed 5 per cent of the assessed valuation thereof. Such bonds shall bear not to exceed 6 per cent interest, shall have coupons attached, and shall be due in ten equal installments, the first of which shall become due and payable not more than eighteen months after date, and one each consecutive year thereafter. A tax shall be levied to pay the interest and principal of such bonds as they become due.

Mississippi

For the purpose of road and bridge improvement, the county board of supervisors may issue bonds of the county to an amount not exceeding, including all of its bonded indebtedness, 5 per cent of the assessed valuation of all taxable property in the county. These bonds shall run not exceeding forty years, shall bear interest at the rate of 6 per cent, and shall be redeemed by a sinking fund to be provided for that purpose by annual taxation.

The board of supervisors of any county is authorized to issue bonds in an amount not to exceed in the aggregate, with outstanding bonded indebtedness, 5 per cent of the assessed valuation of the county, to construct and extend the public highways of the county to connect with the improved highways of adjoining counties, so as to form a continuous system of improved intercounty highways. Such bonds shall bear not to exceed 6 per cent interest and mature not later than 40 years from date of issue.

Supervisor districts may issue bonds for road purposes on petition to the county board of supervisors signed by 20 per cent of the qualified electors of the district. A favorable vote by a majority of those voting at an election to be called for that purpose is necessary to authorize the issue. These bonds shall run not exceeding twenty-five years, shall bear not exceeding 6 per cent interest, shall be exempt from taxation, and shall be sold for not less than par. A tax shall be levied annually to pay the interest and create a sinking fund for the discharge of such bonds at maturity.

Board of supervisors may require adjoining road districts which have constructed, or are constructing, improved roads to connect such improved roads, and apportion the cost thereof to the various districts. Said boards may, if necessary, authorize such districts to issue additional bonds to the amount required to make such connections. If 25 per cent of the electors of any such district, or districts, shall petition against such bond issue, then bonds shall not be issued unless at an election held for that purpose the majority of electors of such district, or districts, respectively, shall vote in favor of same.

When the sinking fund of any road district shall accumulate to an appreciable amount before the time for redemption of the bonds for which it is created, the road commissioners of such district may loan such accumulation at not less than 6 per cent interest on first-mortgage real estate security, on the basis of one-half of its assessed valuation.

Missouri

When petitioned by 100 tax-paying citizens of any county, the county court thereof may submit to a vote the question of issuing bonds for road and bridge purposes, and a two-thirds majority vote of those voting is required to authorize the bond issue. Such bonds shall be coupon bonds and issued in such amount as will not, with the existing indebtedness of the county, exceed the constitutional limitation of 5 per cent of the assessed valuation of the taxable property therein; they shall bear not to exceed 5 per cent interest, shall be exempt from taxation, and shall mature and be payable within 20 years upon the call of the county court. The principal sinking fund and interest of these bonds shall be paid by a tax levied for this purpose.

Special road districts may be organized and the board of commissioners thereof may call an election to determine whether bonds shall be issued for road purposes. A two-thirds majority of those voting shall be necessary to authorize the issuance of these bonds, which, if issued, shall be in an amount, including existing district indebtedness, not to exceed 5 per cent of the assessed valuation of the district. The bonds shall bear not exceeding 6 per cent interest, shall become due in not exceeding fifteen annual installments, the first of which shall become due not later than two years after the date of the bonds. The bonds shall be sold to the best advantage by the board of commissioners.

Montana

The board of county commissioners of any county may issue coupon bonds in an amount which, with the outstanding bonded indebtedness, will not exceed 5 per cent of the assessed valuation of the taxable property therein; provided that no county shall incur any indebtedness or liability for any single purpose to an amount exceeding $10,000, without the approval of a majority of the electors thereof.

Nebraska

Any county, township, precinct, city, or village may issue bonds to construct a highway bridge across any boundary river of the State, if so voted by three-fifths of the voters at a special election. The amount of bonds must not exceed 10 per cent of the valuation. In any county, township, precinct, city or village which has made donations to railroads or other internal improvements, a two-thirds vote shall be required for such bonds. The interest shall not exceed 7 per cent. There shall be an annual tax for interest and sinking fund. The term of the bond is not designated.

Similar provision is made for purchasing private bridges within any township or across any river bounding a township. For such purpose a two-thirds majority is required and the bonds shall bear not to exceed 8 per cent interest. A yearly tax must be levied to pay 5 per cent of the principal annually and the interest on the bonds. Any county or city in the State is authorized to issue bonds for internal improvements, and it appears that such improvements include highways.

Nevada

On a majority vote of the qualified electors of any county, the board of county commissioners may issue bonds of the county to create a fund to be known as the "county road and bridge fund," to be used in the construction, repair, and maintenance of the county roads and bridges, and the purchase of necessary implements and machinery for this purpose. The amount of these bonds shall not exceed the equivalent of 3 per cent of the total assessed valuation of the real and personal property in the county. The bonds shall have interest coupons attached, shall bear not to exceed 6 per cent interest, shall be in denominations of $1000, $500 or $100, as determined by the board of county commissioners, and shall be numbered consecutively from first to last, and must not be sold for less than par. On January 1 of the third year succeeding their sale and annually thereafter, one or more of these bonds, as shall be designated by the board, in consecutive order, shall be paid and redeemed by the county, and an annual tax shall be levied to pay the interest on them and to create a sinking fund for their retirement.

New Hampshire

No general road bonding law.

New Jersey

The board of chosen freeholders may issue bonds of the county in an amount, including existing indebtedness, not exceeding 3 per cent of the assessed valuation of the real estate therein; provided that in no case shall the amount of such bonds outstanding at any one time exceed $300,000. These bonds shall bear interest not to exceed 5 per cent, and shall run presumably for forty years. Before issuing the bonds, the board of chosen freeholders shall make application in writing to the circuit court of the county for authority to issue the bonds, and the circuit court shall investigate and determine whether the bonds shall be issued.

The board of chosen freeholders of a county, or the township committee of a township, or the proper governing body of other municipality, may, by resolution, issue bonds thereof to pay the share of the county, township, or other municipality in the cost of State-aid road work therein. These bonds shall bear not exceeding 5 per cent interest and shall run not exceeding thirty years.

The board of chosen freeholders may issue bonds of the county in an amount, including existing indebtedness, not to exceed 3 per cent of the assessed value of the real estate therein; provided that in no case shall the amount of such bonds outstanding at any one time exceed $300,000. Such bonds shall bear not to exceed 5 per cent mterest and shall run for not to exceed 40 years. Before issuing such bonds, the board of chosen freeholders shall make written application to the circuit court for authority to issue the bonds, which court shall investigate and determine whether or not the issue shall be made.

The board of chosen freeholders of a county, the township committee of a township, or the proper governing body of other municipality, may, by resolution, issue bonds thereof to pay the share of such county, township, or other municipality in the cost of State-aid road work therein. Such bonds shall bear not to exceed 5 per cent interest and shall run for not exceeding 30 years.

The board of chosen freeholders of any county is authorized to repair or reconstruct county roads and to issue bonds in payment of the cost thereof. Such bonds shall bear not to exceed 5 per cent interest and shall be payable at any time not exceeding 5 years from date of issue.

When a navigable stream marks the dividing line between two or more counties and the boards of chosen freeholders of such counties, respectively, shall have resolved, or may resolve, that a bridge across such stream is a public necessity, or that an existing bridge across said stream should be rebuilt, the same may be done by the said boards of chosen freeholders jointly, the expense thereof to be borne by such counties in such proportions as may be agreed upon by the said boards of chosen freeholders. If desirable, bonds may be issued by each county for its proportionate share of the cost of such bridge. Such bonds shall bear not to exceed 4½ per cent interest and run for not exceeding 30 years.

To meet the expenses incurred for the acquisition, development and improvement of parks and parkways in any county, the board of chosen freeholders may, from time to time, in addition to any bonds theretofore authorized by law, on the requisition of the board of park commissioners, borrow money by issuing the bonds of said county, not exceeding in the aggregate $550,000, to run for not exceeding 50 years and to bear not to exceed 4½ per cent interest.

It is provided (Chapter 245, L. 1914) that a commission may be appointed for three or more contiguous counties to construct one or more bridges or tunnels over or under a navigable stream or river which forms a part of the boundary of the State, and such counties may, respectively, issue bonds to meet the cost thereof. Such bonds shall be issued in such amounts and shall bear such interest, not exceeding 5 per cent, and be payable at such time as the governing bodies of such counties may, by resolution, determine.

New Mexico

When petitioned by not less than 10 per cent of the qualified electors of the county who are taxpayers, the board of county commissioners may submit the question of issuing bonds of the county for road purposes. A majority of those voting is required. The amount of the bonds shall not exceed in the aggregate, including existing indebtedness, 4 per cent on the value of the taxable property within the county, shall bear not to exceed 5 per cent interest, and shall run not to exceed thirty years, but may be made redeemable prior to the date of their maturity, as may be provided by order of the board of county commissioners. An additional annual tax levy shall be made to meet the interest charges on the bonds, and there shall be created a fund to be known as the "county highway sinking fund," which shall be used for the redemption of bonds so issued.

New York

The county board of supervisors may, by resolution, authorize the issuance and sale of bonds for paying the county's share of the cost of any highway. These bonds must not be sold for less than par, and the amount of the issue must not increase the total county indebtedness to more than 10 per cent of the assessed valuation.

For the purpose of purchasing toll roads and bridges, the county board may issue bonds which shall bear interest not exceeding 5 per cent, shall run not longer than twenty years, and shall not be sold below par.

Towns may issue bonds for road purposes when authorized by the county board of supervisors. In the case of towns, a majority vote may increase the amount of issue to one-third of the assessed valuation of the town.

North Carolina

Upon presentation of a petition by not less than one-fourth of the qualified voters of any township to the board of county commissioners, the board shall within thirty days order an election in the town to determine if bonds shall be issued. This election shall be held subject to the rules and regulations of the general election laws of the State, and a majority vote of the qualified voters shall be necessary. Such elections shall not be held oftener than every twelve months. The amount of bonds that may be so issued shall not exceed $50,000 for any one township in any county, and the bonds shall be paid by the township for which they are issued, and shall not be chargeable against any property or polls outside of the township. These bonds shall be coupon bonds, shall bear not to exceed 5 per cent interest, and shall be sold for not less than par value, and the interest and sinking fund charges shall be met by appropriate annual taxation. The fund raised by this taxation in excess of the amount required to pay interest shall be safely invested by the board of commissioners and the county commissioners are authorized to purchase any of these bonds to the amount of this excess annually, and after ten years they may purchase at a sum not exceeding par value, one-twenty-fifth of the bonds issued for any township.

North Dakota

Section 183 of article 12 of the constitution authorizes counties, townships, cities, towns, or other political subdivisions to create an indebtedness not to exceed 5 per cent of the assessed valuation of the taxable property therein, but apparently there has been no general statutory enactment permitting the creation of an indebtedness for road purposes under authority thus conferred.

Ohio

Authority is conferred upon township trustees to issue bonds of the township in denominations of $500 to bear not exceeding 6 per cent interest per annum, to run not exceeding thirty years, and to be sold for not less than par, and the aggregate amount of such bonds which may be outstanding at any one time is not to exceed $50,000. Not more than 5 miles of road may be improved in any one year, and no more bonds shall be issued than shall be required to pay the cost of such improvements for the current year. A tax of not exceeding 3 mills on the dollar of all taxable property in the township shall be levied each year until the interest and the principal of the bonds are paid.

The township trustees of a township may create a road district and may issue the bonds of the road district to bear not exceeding 5 per cent interest per annum, and to run not exceeding twenty years, and the amount of bonds that may be outstanding at any one time is not to exceed $100,000. Before these bonds shall be issued, the proposition shall be submitted to a vote of the qualified electors of the district.

In any county, adjacent townships, not exceeding four, may be organized into a road district to improve the roads. When the construction of such a road district is petitioned for by at least fifty resident taxpayers of each of the townships, a road commission of not more than one member from each township, shall be nominated by the township trustees and appointed by the county commissioners. These road improvements must be indorsed by the qualified voters of the district at an election to be held for that purpose. The road commission may issue bonds to run not exceeding 15 years, to bear not exceeding 6 per cent interest, to be sold for not less than par value, and not to exceed, in the aggregate, $250,000 to be outstanding at any one time, unless the taxable valuation of the district shall exceed $5,000,000, when $25,000 additional bonds may be issued for each million of assessed valuation over $5,000,000. To meet the interest and principal of such bonds, the county commissioners shall levy on all taxable property in the district an additional tax of not to exceed 3 mills on the dollar.

In addition, there are numerous special provisions of law under which county commissioners may issue county bonds, and township trustees may issue township bonds for road improvement purposes.

Under the act approved May 31, 1911, as amended in 1913 providing for State aid in the construction of "inter-county highways, etc.," the county commissioners of any county are authorized to issue bonds in anticipation of collections of revenue from the assessment of a special tax for the purpose of constructing, improving or repairing roads under the act, and obtaining State aid therefor. Such bonds shall state the purpose for which they are issued, and shall bear interest not to exceed 5 per cent per annum, payable semiannually, and mature not later than ten years from the date of issue, as the county commissioners shall determine, provided the aggregate amount of these bonds shall not exceed 1 per cent of the tax duplicate of the county. The bonds shall be advertised in two newspapers published in the county at least once each week for four consecutive weeks, and shall be sold to the highest bidder at not less than par and accrued interest, and the county commissioners may reject any and all bids. The proceeds of such bonds shall be used exclusively in constructing, improving, maintaining or repairing the road for which they were issued, except that any unexpended balance shall become a part of the general road funds of the county.

Oklahoma

The township board may issue bonds in an amount not exceeding 3 per cent of the taxable property upon a three-fifths vote at a special election. The bond interest shall not exceed 6 per cent, and the term shall not exceed twenty-five years. An annual tax shall be levied to pay the interest and to create a sinking fund for the redemption of the bonds at their maturity.

The county commissioners of any county are authorized, upon a three-fifths vote of those voting at a special election, to issue county bonds for building, repairing or acquiring bridges, and the term of the bonds shall not exceed twenty-five years and their interest shall not exceed 5 per cent. An annual tax is levied to meet the interest and sinking fund charges on the bonds.

Road improvement districts of not less than 8 square miles in area may be created in any county upon written petition signed by 15 per cent of the qualified electors of the proposed district, filed with the county clerk. Such petition shall ask for a vote on the bond issue for the improvement of the roads in the district, and at the election a three-fifths majority of those voting shall be required to authorize the issuance of bonds. Interest on these bonds shall not exceed 5 per cent, and the term shall not exceed twenty-five years. The board of county commissioners shall annually levy upon all the taxable property in the road improvement district a tax sufficient to pay the interest on the bonds and to create a sinking fund for their redemption.

Oregon

A proposition to issue county road bonds may originate in either of four ways: First, upon the petition of the registered voters equal to one-fourth of the greatest number of votes cast for any candidate for judge of the supreme court at the last general election in that county, or by 5000 registered voters, the county court *shall* submit a proposition to issue county road bonds at a special election called for that purpose; second, upon the petition of one-twentieth of the registered voters, as above, the proposition *may* be submitted at a special election; third, upon the petition of one-tenth of the registered voters, as above, the proposition *shall* be submitted at the next general election; and fourth, the county court *may* submit the proposition at any general election of its own motion.

Upon a favorable vote of the majority of all those voting at the special or general election, the county court shall issue the road bonds or the county warrants in lieu thereof, as funds are needed. The bonds shall be issued in denominations of not less than $50 nor greater than $1000, and shall bear interest not to exceed 6 per cent. The aggregate of all bonds outstanding shall not exceed 2 per cent of the assessed valuation, and shall be sold to the highest bidder. The proceeds shall be expended only in constructing permanent public roads as specified in the order submitting the proposition. A special tax may be levied to pay interest charges, and to provide a sinking fund for the payment of the principal, or provision therefor may be made by transferring funds to such sinking fund.

Pennsylvania

The county commissioners of the several counties may borrow money for improving and maintaining the public roads, and may issue bonds for these improvements. The amount shall not exceed in the aggregate 2 per cent of the total of the assessed valuation of all property in the county at the last triennial valuation; but, no such bonds or indebtedness shall bear interest exceeding 5 per cent. The county commissioners shall not issue bonds in one year to exceed one-half of 1 per cent of the total valuation of all property, as shown at the last triennial assessment; provided, that the amount of bonds issued in any one year in excess of one-tenth of 1 per cent of such total valuation of all property shall be approved by the grand jury and court of quarter sessions.

Rhode Island

No general road bonding law.

South Carolina

No general road bonding law.

South Dakota

It is provided in article 25, section 1137, of the revised code of 1903, that the boards of supervisors of organized townships are authorized to issue coupon bonds when directed by a two-thirds majority of the voters, at a town meeting called for that purpose. Under the amendment of 1911, chapter 250, these bonds or orders are to be payable in such amounts and at such times, not exceeding ten years from date, as two-thirds of the legal voters present and voting shall determine, with interest not exceeding 6 per cent per annum, payable annually. The section of the original article agrees with this amendment in its provision that the above action may be taken at an annual town meeting duly advertised.

Section 1139 of the original act provides that the board of supervisors must levy a tax for interest and principal not exceeding 15 per cent of such maturing bonds, and section 1140 of the original act provides that whenever a petition bearing the signatures of two-thirds of the legal voters of a township asks that an amount of money not exceeding 5 per cent of the taxable valuation of the town and not exceeding $5000 be raised for the construction of any public road or roads, the supervisors shall issue and sell coupon bonds for the amount specified. The term shall not exceed twenty years and the interest shall not exceed 10 per cent, payable annually, and these bonds are to be sold for not less than par value. The interest and principal are to be provided for by taxation. Money so obtained is to be used under the direction of the supervisors of the town involved.

Tennessee

Under an act approved September 27, 1913, the county court of any county, when authorized by a majority vote at an election held for the purpose, may issue coupon bonds for highway purposes in any amount which will not increase the outstanding indebtedness of the county to more than 10 per cent of the taxable valuation. These bonds shall bear interest at not exceeding 6 per cent, shall not run for more than forty years, and shall not be sold for less than par; provided that a two-thirds vote may authorize a bond issue that may increase the outstanding indebtedness to an amount not to exceed 15 per cent. The county court provides the levy for interest and retiring the bonds and also for creating an annual maintenance fund equal to 2 per cent of the bond issue.

In case of federal aid, the court is authorized to appropriate an amount not to exceed double the federal aid, and, in case there are insufficient funds in the treasury, may issue bonds not to exceed 3 per cent of the taxable valuation.

The county court must adopt a resolution setting forth the roads to be built or improved and the number of miles thereof, and may authorize the expenditure for the employment of engineers and payment of expenses incident to the preparation and preliminary plans for the improvement to be made under this act.

The county court shall have the right to divide the county into districts (not less than three nor more than eight) and there shall be elected one road commissioner from and for each district; provided that any county not desiring districts shall have the right to elect three commissioners at large who shall constitute the county board of commissioners.

The commissioners shall let all work for grading, macadamizing, concreting, bridge building, etc., by contract. They shall employ an engineer to lay out and estimate the cost of the improvement and supervise the work done under this act.

Texas

Any county, political subdivision, or other defined district of the county, upon a vote of two-thirds majority of the resident, property-holding taxpayers, may issue bonds for road purposes in an amount not to exceed one-fourth of the assessed value of the real property therein. These bonds shall run for not less than twenty nor more than forty years, with such option of redemption as may be fixed by the commissioners' court, shall bear not more than 5½ per cent interest per annum, and must be examined by the attorney general and registered by the state comptroller of public accounts. The county commissioner's court shall levy a tax sufficient to pay the interest on these bonds and produce a sinking fund sufficient to redeem them at maturity. Each political subdivision or defined district so issuing bonds shall be made a body corporate, and may sue and be sued in like manner as counties. The county commissioner in whose precinct the political subdivision or defined district is located shall be ex-officio road superintendent of the road district, with power to contract for and on behalf of it.

Utah

The board of county commissioners may contract bonded indebtedness by an order specifying the purposes for which the indebtedness is to be created and the amount of the indebtedness, and by providing for submission of the proposition to the electors of the county at the next succeeding general election, or at a special election to be called for that purpose. At this election only such qualified voters as have paid a property tax in the county in the year preceding the election shall be permitted to vote on the question of issuing bonds. A majority of those voting shall be necessary to authorize the issuance of bonds. If the bonds are issued, the board shall levy a tax necessary to pay the interest on them and to create a sinking fund for their redemption at maturity. Bonds shall not be in an amount which, including existing indebtedness, will exceed 2 per cent of the value of the taxable property of the county.

Vermont

Any town or incorporated city may issue bonds to an amount not exceeding three times its grand list for the purpose of purchasing road-making apparatus and building permanent highways therein. To authorize such bonds a two-thirds majority vote of all those cast at a meeting of the town or corporation for that purpose shall be necessary. These bonds shall be issued for a term not exceeding twenty-five years, with interest coupons attached bearing not to exceed 5 per cent interest. The town, city or village must by vote determine the time, place, manner of payment, and the terms, denominations and conditions of such bonds.

Virginia

Upon the petition of a majority of the board of supervisors of any county or upon the petition of 150 freeholders of a county to the circuit court thereof, the circuit court may order an election to determine whether the board of supervisors of the county shall issue county bonds for road purposes. A majority of the qualified voters of the county will be necessary. The amount of the bonds, including all bonds previously issued and remaining unpaid, shall in no case exceed 10 per cent of the total taxable value of the county. These bonds shall be issued in denominations of $100 or some multiple thereof, shall bear not to exceed 6 per cent interest, and shall be payable not exceeding thirty-four years from the date thereof, but may, in the discretion of the board of supervisors, be made redeemable at such time or times as the board may prescribe and stipulate upon the face of the bonds when issued. After the issuance of the bonds, a tax shall be levied in the county on all property liable to State tax to an amount sufficient to meet the interest on the bonds and create a sinking fund for their redemption at maturity.

The board of supervisors, or local county road board if there be one, shall apply to the State highway commissioner for, or shall employ a competent road engineer to make plans and specifications for and supervise the improvements made from the proceeds of the bond issue.

Bonds may be issued by any county for the purpose of macadamizing or otherwise improving the public roads and bridges of any magisterial or road district in such county. Before the bonds are issued, a petition signed by a majority of the board of supervisors of the county or by fifty freeholders of any magisterial district or districts in the county shall be presented to the circuit court of the county, which shall order an election to be held to determine whether the bonds shall be issued. A majority of the qualified voters of the district voting thereon shall be necessary to carry the election. The amount of these bonds shall not exceed 10 per cent of the total assessed taxable values at the time in the magisterial district. These bonds shall be in denominations of $100 or some multiple thereof, shall bear not exceeding 6 per cent interest per annum, and shall be payable within not exceeding thirty-four years from the date thereof, but may, in the discretion of the board, be made redeemable at such time or times and upon such notice as the board may prescribe and stipulate upon the face of the bonds when issued. The necessary tax levy shall be made by the board on all taxable property liable to State tax in the magisterial district, in order to meet the interest on the bonds and to create a sinking fund for their redemption at maturity.

Under a clause in article 5 of chapter 76 of the laws of 1908, when more than 50 per cent of the expense of permanent road improvement in any county is expended in accordance with provisions of the act, that county shall be entitled to receive its annual apportionment of State aid until its receipt from the State on that account shall equal 50 per cent of the expense.

Washington

There are in Washington three operative statutes passed and effective in the years 1890, 1893 and 1913, respectively. The last two are very similar, and the act of 1913, as therein stated, is intended to confer additional power and authority. Bonds may be issued under the provisions of either of these statutes.

The board of county commissioners of any county may, by the act of 1890, whenever a majority of them shall so decide, submit to an election the question of issuing coupon road and bridge bonds in an amount not to exceed 5 per cent of the taxable property in the county, bearing not to exceed 6 per cent interest per annum, and payable at such time as may be fixed by the board of county commissioners. This proposition may be submitted at a general election and a majority of three-fifths of the votes cast is necessary to authorize the issue of these bonds. If bonds are issued, the county commissioners must ascertain and levy annually a sufficient tax to pay the interest on them when they become due and to create a sinking fund to redeem them at maturity.

The county commissioners are authorized by the act of 1893 to establish and construct a system of improved roads on petition setting forth that the public welfare requires that such improvements should be begun without delay and that the county has not sufficient funds. If the commission shall approve the petition, they may by resolution direct that an election be called on the question of issuing bonds of the county to provide funds. If three-fifths of those voting are favorable, the commissioners shall issue the bonds and negotiate their sale at not less than par value. These bonds shall be made payable to the bearer within not more than twenty years from their date and shall bear not exceeding 6 per cent interest. Bonds shall not be issued under the provisions of this chapter in such an amount as will make the aggregate indebtedness of the county exceed 1½ per cent of the value of taxable property therein. When bonds are issued, the board of county commissioners is authorized and required annually to levy and collect a tax sufficient to pay the interest on them, and, in case they are to run longer than ten years, they shall annually levy and collect, beginning with the annual tax levy succeeding the expiration of ten years from the date of the bonds, an additional tax to provide a sinking fund for the payment of the principal thereof. This annual sinking fund levy shall be at least equal to 10 per cent of the amount of the bonds issued.

An act passed in 1913 authorizes the board of county commissioners of any county to submit to the voters of the county the question of issuing negotiable coupon road bonds in an amount not to exceed 5 per cent of the taxable property of such county. This question may be submitted at the general election or at a special election called for that purpose. A three-fifths majority of the votes cast shall be necessary to authorize the issuance of the bonds. If issued, they shall run not to exceed twenty years and bear not to exceed 6 per cent interest. The provisions of this act shall apply not only to roads which are or shall be under the general control of the county, but also to all parts of the State roads in the county and to all roads which are situated or are to be constructed wholly or in part within the limits of any incorporated city or town therein; provided that the board of county commissioners finds that they form or will become a part of the public highway system of the county; provided further that no proposition for bonds shall be submitted which proposes that more than 40 per cent of the proceeds thereof shall be expended within any city or town or within any number of cities and towns. After the bonds are issued, the county commissioners shall levy an annual tax sufficient to pay the interest and at least five years prior to the maturity of the bonds, and thence forward each year until their maturity the county commissioners must ascertain and levy a tax sufficient to accumulate during the last series of years a fund equal to the principal of all the bonds then remaining outstanding and unpaid. The proceeds of this tax shall go into a sinking fund for the discharge of the bonds.

West Virginia

The county court of any county may improve the main roads thereof, and may pay for them by the issuance of the bonds of the county. In this case the court, upon petition of fifty legal voters of the county, shall submit the proposition at a general school or special election, and a three-fifths favorable vote of all votes cast shall be necessary to authorize the issuance of the bonds. The amount of bonded indebtedness that may be outstanding at any one time shall not exceed 5 per cent of the value of the taxable property within the county. Interest on these bonds shall not exceed 6 per cent, and the bonds shall be sold at not less than par. The term not exceed thirty-four years, and an annual tax shall be levied on all property subject to taxation in the county sufficient to meet the interest and to create a sinking fund for the redemption of the bonds at maturity.

In like manner the county court may issue road bonds of any magisterial district within the county.

Wisconsin

Any county, through its board, may issue nontaxable coupon bonds bearing interest at 5 per cent, payable semiannually, for the original improvement of any portion of the system of prospective State highways. The bonds may run not to exceed ten years, and the entire issue, when added to other county indebtedness, must not exceed 5 per cent of taxable property, as ascertained by last assessment. The bonds may not be sold below par outside of the county until the residents of the county have had a reasonable opportunity to purchase them, and when sold, the proceeds must be apportioned to the respective towns by the county board. The form of the bonds is to be approved by the State highway commission, and the bonds are to be printed from plates furnished by the commission.

The bonds are to be divided as to denominations and due dates so as to have an equal amount payable each year. The interest and principal are provided for by a direct tax to be assessed by the county board. Provision is also made for the issuance of bonds conditioned upon the payment of all interest by private subscriptions, but money or approved securities must be first deposited to secure the payment of this interest. State aid may be obtained upon proceeds from bond sales not to exceed one-half of the tax levy in the county for the payment of the face of the bonds.

No bond issue shall be authorized for more than one-fifth of 1 per cent of the assessed value of all the taxable property in the county until the proposition has been submitted to a vote of electors of the county, and a majority of those voting have been favorable. A petition signed by qualified electors equal to 10 per cent of the number of votes cast for governor at the last general election may secure the submission to a vote of any proposition to issue bonds.

Any town may issue bonds for the original improvement of any portion of the system of prospective State highways in a manner similar to that of the county, except that the proposition must, without exception, be submitted to a vote of the qualified electors of the town at a regular town meeting, or at a special meeting called for the purpose. The rate of interest and other terms of the bonds are practically identical with those of the county.

Wyoming

The State constitution authorizes the county and subdivisions thereof to create indebtedness not to exceed 2 per cent of their taxable valuation, but there has been no statutory enactment, either general or special, under the authority thus conferred, for the issuance of road bonds.

BOND ISSUES FOR ROAD IMPROVEMENT

A comprehensive bulletin on highway bonds was issued by the Office of Public Roads of the United States Department of Agriculture in February of this year (Department Bulletin No. 136). The bulletin shows that there were outstanding highway bonds in 1,230 counties on January 1, 1914, aggregating $286,557,073. As indicating the growth of bond issues, the bulletin points out that in 1911 there were $29,200,000 of bonds issued, in 1912, $32,022,000; and in 1913, $50,445,000. It is also

Annual payments which, with interest at 3, 3½, and 4 per cent, compounded semiannually, will amount to $1,000 at the end of a term of years

YEARS	ANNUAL PAYMENTS		
	3 per cent	3½ per cent	4 per cent
1	$1,000.0000	$1,000.0000	$1,000.0000
2	492.5562	491.3266	490.1000
3	323.4583	321.8368	320.2221
4	238.9468	237.1428	235.3498
5	188.2699	186.3672	184.4796
6	154.5102	152.5508	150.6104
7	130.4175	128.4252	126.4560
8	112.3666	110.3564	108.3733
9	98.3436	96.3254	94.3382
10	87.1402	85.1208	83.1366
11	77.9872	75.9717	73.9954
12	70.3721	68.3643	66.3996
13	63.9399	61.9427	59.9924
14	58.4372	56.4527	54.5191
15	53.6780	51.7080	49.7928
16	49.5229	47.5689	45.6734
17	45.8652	43.9283	42.0537
18	42.6221	40.7032	38.8504
19	39.7280	37.8279	35.9976
20	37.1306	35.2499	33.4426
21	34.7875	32.9267	31.1429
22	32.6639	30.8236	29.0636
23	30.7313	28.9116	27.1759
24	28.9656	27.1670	25.4557
25	27.3469	25.5696	23.8829
26	25.8582	24.1024	22.4404
27	24.4850	22.7508	21.1136
28	23.2149	21.5024	19.8901
29	22.0373	20.3465	18.7591
30	20.9428	19.2739	17.7113

pointed out that State highway bonds issued or authorized to January 1, 1914, amounted to $158,590,000, making a grand total of all highway bonds voted to January 1, 1914, of $445,147,000.

The table on page 91 shows the amount necessary to be raised each year in order to retire a $1000 bond by the sinking fund method.

The serial bond, which has become rather general for highway purposes in recent years, retires a fixed portion of the principal each year and is quite a desirable method of retiring public indebtedness by reason of the fact that the interest rate on the bonds retired is usually higher than the interest which can be earned on a sinking fund. The following table shows the amount which must be provided annually for a period of twenty years to retire a serial loan of $100,000 bearing 4 per cent interest:

Schedule of interest and principal to retire a serial loan of $100,000 at 4 per cent, with annual principal repayments of $5,000

YEARS	PRINCIPAL OUTSTANDING AT BEGINNING OF YEAR	INTEREST FOR YEAR	PRINCIPAL REPAID AT END OF YEAR	TOTAL
1	$100,000	$4,000	$5,000	$9,000
2	95,000	3,800	5,000	8,800
3	90,000	3,600	5,000	8,600
4	85,000	3,400	5,000	8,400
5	80,000	3,200	5,000	8,200
6	75,000	3,000	5,000	8,000
7	70,000	2,800	5,000	7,800
8	65,000	2,600	5,000	7,600
9	60,000	2,400	5,000	7,400
10	55,000	2,200	5,000	7,200
11	50,000	2,000	5,000	7,000
12	45,000	1,800	5,000	6,800
13	40 000	1,600	5 000	6,600
14	35,000	1,400	5,000	6,400
15	30,000	1,200	5,000	6,200
16	25,000	1,000	5,000	6,000
17	20,000	800	5,000	5,800
18	15,000	600	5,000	5,600
19	10,000	400	5,000	5,400
20	5,000	200	5,000	5,200
Totals..	....	42,000	100,000	142,000

The saving by the serial method as compared with the sinking fund method is quite marked, as indicated by the following table, which shows the total cost of a loan of $100,000 for twenty years with interest compounded annually under the sinking fund, the annuity, and the serial methods respectively. The annuity bond differs from the serial bond in that the former calls for payment of principal and interest by a constant annual or semiannual payment, while under the serial bond only the principal retired each year remains fixed.

Total cost of a loan of $100,000 for 20 years, interest compounded annually

ANNUAL INTEREST ON BONDS	SINKING FUND COMPOUNDED ANNUALLY AT			ANNUITY	SERIAL
	3 per cent	3½ per cent	4 per cent		
4	$154,431	$150,722	$147,163	$147,163	$142,000
4½	164,431	160,722	157,163	153,752	147,250
5	174,431	170,722	167,163	160,485	152,500
5½	184,431	180,722	177,163	167,359	157,750
6	194,431	190,722	187,163	174,369	163,000

DIGEST OF CONVICT LABOR LAWS

Alabama

The convicts of any county or municipality may be worked upon the public roads, bridges or ferries of the county under the direction of the court of county commissioners, or they may be hired to contractors.

Arizona

The State board of control may cause persons convicted of crime and placed in the state prison to be employed in the construction and maintenance of State roads and bridges. Such prison labor shall conform to directions and specifications of the State engineer, and shall be performed in the several counties only when requested by the county supervisors thereof. The board of control and the State engineer are clothed with ample authority for the effective administration of this act.

Arkansas

The department of State lands, highways and improvements shall employ as many of the State convicts on the public roads as may not be otherwise employed by the penetentiary authorities, the expenses to be borne by the county or improvement district in which they work.

County convicts may be worked upon the highways of the county, and it is lawful to provide in any highway charter for working the male county convicts upon the highways of the county. In case such district is not coextensive with the county from which they come, the county court shall first approve the provision. Special improvement districts may use convict labor and pay a flat rate of 75 cents to the county.

Colorado

At the request of the board of county commissioners the warden of the State penitentiary shall detail such a number of prisoners to work on the public roads as he shall deem proper. The additional cost of guarding and other expense must be borne by the county.

Connecticut

Convict labor on highways is not provided except work for a day or two on roads of town in which county jail is located.

Delaware

In the counties of Kent and Sussex, vagrants and minor criminals may be sentenced to hard work on the county roads.

In New Castle County, the levy court is empowered to arrange for employing any of the able bodied convicts on the public roads.

Florida

The county commissioners may employ all convicts in jail under sentence for crime at labor upon the streets of cities and towns or upon roads, bridges and public works; or the board may hire out convicts. There is no provision for working state convicts upon roads.

Georgia

Convicts guilty of misdemeanors may be sentenced to work in the chain-gang of the county. All felony convicts except such as are required by law to be kept at the State farm may be employed in the several counties. On or before February 10 annually, the prison commission shall communicate with the county authorities and ascertain those counties desiring to use convict labor. Convicts shall be apportioned according to population.

Idaho

The highway commission is authorized to make requisition upon the warden of the State penitentiary for convicts for road labor, subject to such rules and regulations as the board of prison commissioners shall prescribe. The warden and prison commission shall assign such prisoners as they deem physically able and at the same time reasonably safe to work on the State roads under the general direction of the highway commission.

Illinois

Convicts are not worked outside of prison except in rock quarries in getting out rock for the use of the State. Crushed rock and other road material created by convict labor shall be furnished free at the penitentiary where prepared to the State highway commission, provided such material shall be placed only upon a permanent public highway.

Indiana

The managing boards of the State reformatory and State prison may wherever there is no work for the inmates within the prison, arrange with the county commissioners or township trustees for working the convicts on the roads.

Iowa

State convicts may be worked at stone quarries, and the crushed stone produced, furnished to counties, townships, or road districts, f.o.b. cars at crushing plant.

Kansas

It is the duty of the warden of the penitentiary to employ the surplus convict labor in extending and repairing the state and county roads. By special act, the State will furnish the necessary labor from the penitentiary to build a macadam road from Leavenworth to Kansas City, provided the counties furnish right-of-way and material.

Kentucky

Prisoners sentenced to work at hard labor may be placed in the work-house, if there be one in the county, or at work upon the public works, or roads, of the county, or upon the public works of any city or town in the county. The place of working such prisoners shall be determined by the county judge, giving preference to work on roads of the county whenever the weather will permit. When placed upon the public works of any city or town, such city or town shall provide and pay for food, lodging, and guarding; and when placed on the county roads, such cost shall be paid out of the road funds of the county. The county judge is authorized to appoint a manager for each crew of prisoners, who shall also act as guard. No crew shall consist of less than three prisoners, and not more than one man shall be paid to guard and manage less than ten prisoners. The county or fiscal court shall have power to prescribe regulations for the government of prisoners and those in charge of them. All prisoners placed at hard labor shall be permitted to satisfy their fines and costs with such labor, at the rate of $1 per day.

An amendment to the constitution is to be voted on by the people to authorize the State to employ State convicts outside of the walls of the penitentiary in road or bridge work, or in the preparation of materials therefor.

Louisiana

The State highway engineer, with the approval of the board of State engineers may use convicts for highway work, such convicts to be under the supervision and guardianship of the board of control of the State penitentiary.

Maine

Upon written application from county or municipal authorities the board of inspectors may direct that jail prisoners be worked on county roads.

Maryland

For the purpose of building and constructing or maintaining any road, bridges or highways under the provisions of this act (State highway act of 1910) or for the purpose of working any stone quarry operated by the State roads commission, the said commission is authorized to make request of the directors of the Maryland House of Correction for as many inmates thereof as may be necessary for said purpose, and the said directors are directed to furnish same with a sufficient number of guards for their safe-keeping of the prisoners while so employed.

The use of convicts on public roads in certain counties is also authorized by law.

Massachusetts

Convicts may be employed in the preparation of road material by hand labor only, and are not employed in the construction and maintenance of highways.

Michigan

County road officials may direct the employment of county prisoners confined for petty offenses, upon the highways of the county.

The wardens of the State penitentiaries may, upon proper application from highway officials, put State prisoners to work in the same manner as county prisoners. State convicts may also be used in surface quarries and stone yards in preparing material to be used on the public highways.

Minnesota

No legislation providing for convict labor upon highways. They may be used for crushing stone for highway purposes on the prison grounds.

Mississippi

There is no general convict labor law in reference to highways. Most convicts are employed upon state farms. The superintendent of the penitentiary is authorized to improve and maintain roads from each convict farm in the State for a distance of 5 miles out from said farms.

In four counties, convicts between the ages of eighteen and and fifty sentenced to the farms may be required to work fifteen days on the roads.

Missouri

The warden and inspectors of the penitentiary may, in their discretion enter into contracts for the employment of not to exceed

300 convicts of the state penitentiary upon public roads and highways of the State at such times and places and upon such terms as the warden and inspectors deem proper.

Montana

County commissioners may require prisoners to labor "on the public works or ways in the county."

Under the State highway commission, act of 1913, county commissioners may have work done by prison or convict labor on State roads in their county.

Nebraska

For the purpose of enabling the county commissioners to employ in a profitable manner all convicts sentenced to hard labor, the board has authority to make rules and regulations and designate the place where the convicts shall work. The county jail is declared to extend to any quarry, road or other place the commissioners may designate.

Nevada

The State prison commissioners are authorized to detail for work on the public highways any male convict in the State prison who may be properly detailed, except prisoners under sentence of death, provided, that such detail shall be voluntary on the part of the convict.

Convicts so detailed are not required to wear stripes, are given ten days off sentence for each month's faithful work, and are paid 10 cents per day.

New Jersey

The board of chosen freeholders of any county may order the sheriff to cause all able bodied male convicts or so many as may be required, to be put to work on the public roads of the county.

The management of the State prison shall be vested in a board of inspectors, consisting of six members, to be appointed by the governor with the advice and consent of the senate. The said board of inspectors is authorized to enter into an agreement with the State commissioner of public roads, or other department of the State government, for the employment of prisoners on public work.

The State commissioner of public roads, or the board of chosen freeholders of any county may make application to the prison labor commission for convicts to work on public highways. The prison labor commission in conjunction with the governing body of the penal institution determine the number to be assigned the cost of maintenance and compensation and may enter into an agreement for the payment of costs or any portion thereof.

The prison labor commission is authorized to acquire so much land for agricultural and quarry purposes as may be selected by said commission, and transfer prisoners for agricultural purposes, and to be employed in the quarrying and preparation of building and road materials.

New Mexico

Aside from the special acts of the legislature which provides for building certain roads by convict labor, a general act of 1909 provides that the State highway commission shall employ such convict labor as shall be available and advisable. The board of penitentiary commissioners shall on demand of highway commission furnish available convicts and also necessary guards, provided that the cost of transportation, maintenance and guarding while engaged in road work shall be paid from the road fund.

New York

The town superintendent with the consent of the town board may request the supervisor of the town under the provisions of section 93 of the county law to procure the services of the prisoners serving in the county jail for general work on the public highways of the town.

The board of supervisors of a county, or the town board of a town in which any portion of a county or State highway is situated, may, on behalf of such county or town, present proposals and be awarded a contract for the construction or improvement of such highways, in accordance with the provisions of law. If such contract be awarded to a board of supervisors or a town board, such board shall, by resolution, designate some suitable person, or persons, to carry into effect such contract and to transact all necessary business in respect thereto, and such board may, by resolution, direct the person, or persons, so designated to apply to the superintendent of State prisons for convict labor in the construction of such highway or section thereof. The resolution shall specify the maximum number of convicts to be applied for. The superintendent of State prisons shall detail for labor, pursuant to such resolutions and requests, such number of convicts as shall be available therefor not exceeding the number applied for. Such convicts shall be in the immediate charge and custody of the officers and guards detailed by the superintendent of State prisons, and shall at all times be subject to the control of such superintendent, except that the work to be done shall be directed by the engineers and foremen of the State highway department. The expense of maintenance of such convicts shall be paid by the county or town entering into such contract, from funds due thereon to such municipality.

North Carolina

In counties having arrangements for working convicts upon public roads, the presiding judge shall sentence the following convicts to such work; all those convicted of crimes, the punishment of which is imprisonment in the county jail; those convicted of crimes, the punishment of which is confinement in the State penitentiary not exceeding ten years; those sentenced to imprisonment in a county jail by a magistrate.

North Dakota

The board of control is authorized to employ convicts upon the public highways, under the supervision of proper guards, all the convicts not needed in the State twine mills, and it is otherwise deemed practicable to so employ them. They may also be employed by the several counties of the State for work on the public roads thereof when it is mutually so agreed by the county commissioners and the State board of control, the county paying all the salaries and expenses in connection with said work. The convicts shall at all times be under State control, and shall be supervised by skilled laborers who shall at the same time act as guards. As nearly as practicable, all the men shall be pledged on their word of honor not to attempt escape, they shall be dressed uniformly, and shall bear some insignia not too conspicuous, and shall not be required to work more than ten hours in any one day. Also, a convict shall not be assigned to work in the community from which he came.

The convicts are entitled to a credit of from 10 to 25 cents per day, the exact amount depending upon the amount and manner of work done, and in addition thereto, those assigned to outside work are entitled to a double allowance of "good time."

Ohio

The governor shall have power to direct and require the Ohio board of administration, the warden, and such other officers who have charge of the keeping and maintenance of the prisoners in the Ohio penitentiary and Mansfield reformatory to furnish to the State highway department such number of able bodied prisoners as the State highway commissioner may certify to the governor can be advantageously employed upon any part or parts of the main market road system. The housing, guarding and maintenance shall be paid from the funds appropriated for such penitentiary or reformatory. Strict account shall be kept of all such labor to determine its actual cost to State.

Oklahoma

The county commissioners shall have authority by providing suitable arrangements therefor, to work all convicts confined in the county jail upon the public highways, and may by arrangements with the city council, work the prisoners of any city, but shall not pay therefor other than the cost of maintenance.

The State board of prison control may provide for the working of convicts upon the public roads of the State. The work shall be done upon roads designated by the county commissioners of the several counties. State convicts shall be divided into groups not exceeding 100 each. Only one group shall work in any county, and for a period not to exceed five months. No county shall receive the second group until all counties making application shall have received their proportion of the work from state convicts.

Oregon

State.—The State highway commission may authorize and provide for the construction of any State road or part of such road by convict labor; and if said commission so authorizes and provides convict labor, the governor shall, upon its request detail from the penitentiary such convicts as in his judgement may seem proper for use in the work of constructing said road or part of a road; and such convicts shall be delivered to said engineer on such terms and conditions as shall be prescribed by the parole board and approved by the governor.

County.—Upon the written request of the county court of any county, the governor may detail from the State penitentiary such convicts as in his judgment may seem proper for use on the public highways. Said convicts shall be delivered to any county court on such terms and conditions as shall be prescribed by the parole board and approved by the governor.

Pennsylvania

All male persons sentenced to county jails and workhouses may be assigned to work on the public roads of the county by the prison board. Preference shall be given to the making of new roads and the repair of main roads, all roads to conform to the plans and specifications of the State highway commission. The work shall be done in 5 mile sections by townships in rotation.

Rhode Island

No convict labor.

South Carolina

Any convict serving a sentence of six months or more, life sentence excepted, in the State penitentiary, or any county jail, or upon the public works of any county, shall be entitled to have one-tenth, of such sentence deducted for good behavior.

The county supervisor of each county in the State may be allowed to use any of the convicts he may select, sentenced from his county to the State penitentiary, without charge, for the purpose of working the roads of his county, or for such other purposes as he may deem proper.

South Dakota

When in the opinion of the sheriff any convict sentenced to hard labor can be more profitably employed outside of the jail or yard, it shall be his duty to employ said convict either in work on public streets or highways or otherwise.

Tennessee

County convicts may be worked upon the public highways of the county, subject to the direction of the county court.

Texas

The commissioners court may require all male county convicts, not otherwise employed, to labor upon the public highways under such regulations as may be deemed most expedient. Each convict worked on the roads in satisfaction of any fine and cost shall receive a credit thereon of 50 cents for each day he may labor and reasonable commutation of time may be granted as a reward for faithful service and good behavior, provided same shall not exceed one-tenth of the whole time.

Utah

Convict labor may be utilized in providing road material and also actual construction. Prisoners in the county jail may be required to work on the county roads under regulations made by the board of county commissioners, and prisoners in the state prison may be required to work on the State roads.

When state prison convicts are used in the construction or improvement of any State road, the work shall be under the authority and control of the State road commission, the state board of correction and the warden of the Utah State prison.

The State board of pardons is required to make provision for granting privileges and reduction of sentence for good behavior on part of convicts employed on roads.

Vermont

The sheriffs of the several counties may employ or cause to be employed able-bodied prisoners confined in county jails, upon conviction for crime, in the improvement of the public highways within a radius of 30 miles from such jail and outside of a city or incorporated village. The county sheriff makes necessary rules for the proper care of such prisoners subject to the approval of the attorney-general and governor. The State highway commissioner shall designate subject to the approval of the sheriff the highways upon which labor shall be employed. The highway commissioner or his assistants shall direct the work.

Virginia

After May 1, 1913, all male prisoners confined in the State penitentiary shall be subject to work on the State convict road force, except those considered unsafe by the superintendent. The road force shall be under the direction of a civil engineer appointed by the State highway commissioner, or of a guard so appointed who shall be well versed in road building. When local road authorities desire to make permanent improvement by contract, the State may furnish such force of convicts that at $1 per day will amount to 40 per cent of the contract price.

Washington

Whenever there are persons confined in the State penitentiary who are physically able to perform manual labor upon the public highways and who shall not be engaged in other work required by the State board of control, the same may be employed upon the construction and improvement of the public highways within the State.

The board of control shall monthly certify to the State highway commissioner the number of persons in the institution named who may be used for the work authorized under this act, and the state highway commissioner shall, whenever possible use such persons in the building or repair of public roads.

All work shall be under direction and supervision of the State highway commissioner, but the control and management of the convicts shall be under the supervision of the State board of control. All expense of care, maintenance and transportation above 25 cents per day for each convict shall be paid from the funds authorized to be used on the road being improved. Twenty-five cents per day shall be paid from the fund appropriated for the maintenance of the penitentiary.

County commissioners may order jail prisoners to work on the public roads under direction of the sheriff at a distance of not to exceed 5 miles from place of detention.

West Virginia

County courts may sentence convicts to be confined at hard labor in the county jail, and may designate what work as roads, bridges, etc.

Proceeds from leasing or hiring inmates of the penitentiary, less $20,000, shall be paid into the State road fund. In the State road bureau act of 1913, it is provided that county courts may apply to the State board of control for State prisoners to work upon the State highways of the county. The application will be granted if prisoners are available, provided, the state board of control may, for good cause, refuse to grant any application.

Wisconsin

Convicts in county jails may be used in breaking stone for road purposes.

Wyoming

Any convict may be put to work on the highways and streets. A recent law (1913) provides for a system of public highways consisting of twelve trunk lines to be improved by prison labor in accordance with plans of the State engineer.

CONVICT LABOR FOR ROAD IMPROVEMENT

The use of convict labor on the public roads has become quite general in recent years. At the present time the States of New York, New Jersey, West Virginia, Ohio, Illinois, Wisconsin, Oklahoma, Colorado, Utah, Wyoming, Montana, Idaho, Washington, Oregon, Arizona, New Mexico, Texas, Florida, Georgia, South Carolina, North Carolina, and Virginia, are trying out the plan of using State convicts on road work. Some of these States are taking up the project on a small scale by way of experiment, while others are utilizing the convicts in this way to a very great extent. Georgia has its entire State and county convict force, aggregating upwards of 6000 prisoners, at work on the public roads.

In some of the States the convicts on the road forces are operating under what is known as the "honor system," under which guards, stripes, chains, bolts and bars are dispensed with. The system of working the convicts under guard prevails, however, in most of the States, and it has not yet been determined to what extent the "honor system" may be safely put into practice.

A wide variation in the cost of operating convict labor is apparent from a study of the various State systems, ranging from a minimum of about $0.60 per convict day for all expenses to as high as $2 per convict day for all expenses.

The Office of the Public Roads of the United States Department of Agriculture, in order to make available all possible information on this important subject, and to indicate the lines along which best results may be accomplished, is now engaged in an exhaustive study of convict labor for road work throughout the United States. Convict camps have already been visited in a majority of the States, the study extending from the Atlantic to the Pacific and to the extreme southern States. It is expected that a bulletin or report will be issued by that Office within the next six months, and in consequence no extended treatment of the subject is practicable or desirable in the *Good Roads Year Book.*

The States in which convict labor has been most extensively used for road construction are Virginia, North Carolina, Georgia, Alabama, Louisiana, Colorado and Washington. Information should therefore be obtainable from George P. Coleman, State highway commissioner, Richmond, Virginia; Dr. Jos. Hyde Pratt, State geologist, Chapel Hill, North Carolina; R. E. Davison, chairman, prison commission of Georgia, Atlanta; and Dr. S. W. McCallie, State geologist of Georgia, Atlanta; W. S. Keller, State highway engineer, Montgomery, Alabama; W. E. Atkinson, State highway engineer, New Orleans, Louisiana; J. E. Maloney, secretary, State highway commission, Denver, Colorado; Wm. R. Roy, State highway commissioner, Olympia, Washington. Investigations have been made relating to convict labor along various lines by Prof. E. Stagg Whitin, secretary, National Prison Labor Committee, New York City.

DIGEST OF STATE CIVIL SERVICE LEGISLATION APPLICABLE TO ROAD OFFICIALS

Illinois

With the exception of the State Highway Commission, the chief State highway engineer, and the assistant State highway engineer, the appointment of all assistants, agents or clerks or other employees of the State highway department shall be subject to the civil service laws of the State. (Roads and Bridges Act, Revision 1913, Sec. 5.)

In each and every county of the State there shall be a county superintendent of highways, appointed by the county board. The county board of each county shall submit to the State Highway Commission a list of from 3 to 5 persons, residents of the county, considered desirable candidates for the office of county superintendent of highways, and the State Highway Commission shall thereupon determine, by competitive examination, from among the names submitted, the person or persons best suited for said office, and shall certify the same to the county board, who shall then make an order appointing from the number found eligible one such person superintendent of highways for such county. If from the list submitted by the county board no one shall be found qualified for the position, then the county board shall in like manner submit another list, and if on this second list no one is found qualified, the county board may employ some person other than a resident of the county who has passed satisfactorily the examination held by the State Highway Commission. The term of office of each county superintendent of highways shall be six years, but any such superintendent of highways may be removed by the county board for incompetency, neglect of duty and malfeasance in office. (Roads and Bridges Act, Revision 1913, Sec. 8.)

Kentucky

There is created in the several counties of the State the office of county road engineer, who is to be appointed by the county judge, by and with the consent of the fiscal court, for a term of two years. Such county road engineer shall be either a reputable civil engineer or a man who has had practical experience as a road supervisor or builder for two years and who shall have passed a creditable examination by the State commissioner of public roads or one of his representatives. (Acts of 1914, Chap. 80, Sec. 39.)

The county road engineer may be removed at any time by the county judge upon his own volition for incompetence, malfeasance or misfeasance in office, upon written charges, after a hearing of which 10 days' notice shall be given by serving a copy of such charges upon such county road engineer. (Acts 1914, Chap. 80, Sec. 40.)

Massachusetts

In all work of any branch of the service of the commonwealth, or of any city or town therein, citizens of the commonwealth shall be given preference. The civil service commission shall not place upon its list any person not a citizen of the United States. If an appointing officer, by reason of the non-existence of an eligible list, shall appoint under provisional authority from the civil service commission a person not a citizen of the United States, he shall discharge the person so appointed and appoint from the eligible list, whenever the civil service commission shall have established a list of the proper class. When the attention of the civil service is called, by a complaint on the part of the citizens, to the employment of a non-citizen when there is an eligible list, the commission shall take steps to enforce the dismissal of such non-citizen and make an appointment in his stead from the suitable eligible list. A penalty is provided for appointing officers continuing the employment of a non-citizen for a period of ten days after having due notice of such unlawful employment. (Acts 1914, Chap. 600.)

New Jersey

The State commissioner of public roads is empowered to employ, as need arises, a staff of qualified road inspectors, certified as such by the civil service commission. Such staff shall not exceed 10 in number and may be removed for cause or assigned to any work pertaining to roads which the State commissioner of public roads may elect. (Acts 1912, Chap. 395, Sec. 6, as amended, Acts 1913, Chap. 317, Sec. 6.)

New York

The State commissioner of highways shall appoint such resident engineers, district superintendents, clerks, officers and employees as may be required, subject to the civil service law and other provisions of law, within the amount appropriated therefor, unless the appointment of such clerks, officers, or employees is otherwise provided for by law. District superintendents, appointed as provided in this chapter, shall be appointed from lists prepared from examinations which shall test their qualifications for the actual construction and maintenance of highways and their executive capacity, rather than their scientific attainments. Clerks, other than those employed in the principal office of the commissioner of highways, inspectors, and other employees in the department, whose duties pertain to the maintenance of highways, shall likewise be selected from lists prepared from examinations, testing their general knowledge of the highway law and of the practical construction of highways. Inspectors of construction, other than engineers and levelers, shall be selected from lists similarly prepared, except that they shall be residents of the county within which the highway constructed or improved is located. To the end that the employees of the department of highways engaged in the work of constructing, improving, or maintaining highways under the provisions of this chapter may be practical highway builders, the commissioner of highways is authorized to indicate to the civil service commission the relative value which should be given to experience and scientific attainments. The commissioner of highways, subject to the provisions of civil service law, may remove the division engineers, resident engineers, district superintendents, clerks, officers and employees of the department. (L. 1909, Chap. 30, Art. 2, Sec. 19.)

Wisconsin

The county board of each county shall elect a competent man as county highway commissioner. Candidates for the office of county highway commissioner shall be examined at the county seat by the State Highway Commission to determine their relative fitness for the position. Said commission shall notify the county clerk of the relative standing of the various candidates, as determined by the examination, and the county board shall elect as county highway commissioner one of the first two men on the list so certified as eligible, striking off the names of those who refuse to qualify when elected. Any county highway commissioner may be removed by the State Highway Commission for cause upon due notice and hearing. Vacancies in the office of county highway commissioner shall be filled by the county board if in session, or by appointment by the chairman of the county board from a list of eligible candidates supplied by the State Highway Commission, if the board be not in session. Upon his first election, the county highway commissioner shall serve until the first Monday in January of the second year succeeding the year of his election; and if reëlected he shall serve until removed by a majority vote of the county board with the consent of the State Highway Commission, or by a two-thirds vote of all members of the county board. (Sec. 1317-6 of the Statutes, as amended, 1913.)

DIGEST OF AUTOMOBILE REGISTRATION LAWS

Alabama. The law provides for annual registration of motor vehicles with the secretary of State. The schedule of fees is as follows: Less than 20 h.p., $7.50; 20 to 30 h.p., $12.50; 30 to 40 h.p., $17.50; 40 h.p. and over, $20; electric machines, $12.50; steam automobiles, $15; motor cycles, $3; manufacturers and dealers, $100; motor vehicles for hire, $25; chauffeur's license, $5.

The automobile revenues are not applied to roads. Forty per cent of the gross revenue derived from owners residing in incorporated cities and towns is returned to such cities and towns, and 40 per cent derived from owners in counties not residing in cities or towns is returned to the county of their residence. (Act, April 22, 1911.)

Arizona. The law provides for annual registration with the secretary of State. The registration fees are as follows: 25 h.p. and less, $5; 25 to 40 h.p., $1 ; over 40 h.p., $15; motor cycles, $2; dealers, one machine in each class, at regular rates; chauffeur's license, $5.

The revenues are credited to the State road tax fund. (Chapter No. 68, Laws 1913.)

Arkansas. The law requires annual registration with the commissioner of State lands, highways and improvements, payment to be made to the county tax collector, whose receipt is forwarded with the application for registration. The fees are as follows: All motor vehicles, $10; dealers, one machine in each class, at regular rate; chauffeur's license, $1.

The revenues are equally divided between the State and the county in which the revenue is collected, the State portion to be credited to the State highway improvement fund. The fees and forfeitures are paid into the general school fund of the county in which they are imposed. (Act No. 134, Laws 1911, as amended by Act No. 302, Laws 1913.)

California. Annual registration is required, the application to be forwarded to the State treasurer with fee and thence transmitted to the State department of engineering, which issues the necessary seals, etc. and makes necessary record. Registration fees are as follows: Less than 20 h.p., $5; thence to 60 h.p. and above, an increase of $5 for every 10 h.p.; motor cycles, $2; dealers, for each five cars operated, $50, and $10 for each additional car; motor cycle dealers, $5; transferring registration from one vehicle to another, $2; chauffeur's license, $2.

Not to exceed $5000 of the revenue may be expended by the State treasurer's office in connection with registration and not to exceed $10,000 by the State department of engineering in connection with registration. Half of the net revenues shall be returned to the county in which collected and credited to the road fund, and the remaining half remains in the State treasury for maintenance of State roads under the direction of the highway department of the State department of engineering. (Act of May 31, 1913.)

Colorado. Annual registration with the secretary of State is required. The fees are as follows: 20 h.p. and less, $2.50; 21 h.p. and 40 h.p., $5; 41 h.p. and over, $10; motor cycles, $2; chauffeur's license, $1.

Revenues are divided equally between the State and the county from which the revenue is received. The State's portion is credited to the State road fund, to be expended in improving and maintaining State roads, and the counties' portion is credited to the road fund of such county. Fines and forfeitures are divided equally between the State and the county and credited in the same way as the registration fees. (Act No. 49, Laws 1913.)

Connecticut. Annual registration with the secretary of State is required. The registration fees are as follows: Automobiles, 50 cents per h.p. with a minimum charge of $5; automobiles, livery, $10: motor cylces, $2; commercial motor vehicles, for first one thousand pounds capactiy, $7; and for each additional one thousand pounds, $3; dealers in motor vehicles, $50; dealers in motor cylces, $10; manufacturers minimum charge, $25; operators license, $2.

The revenues are placed to the credit of the State highway fund to be expended in the maintenance of State highways. (Acts of May 28, and June 4, 1913.)

Delaware. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles, $3; all other motor vehicles, $5; operators, including owners, $5; manufacturers and dealers, for each car demonstrated on the roads, $5.

Registration revenues are credited to the general fund of the State treasury. (Act of April 29, 1909, as amended by Act of March 19, 1913.)

District of Columbia. Regulations provide for registration with automobile board. Schedule of fees is as follows: All motor vehicles, perpetual registration, $2; operator's, including owners, perpetual, $2; dealers license for each machine demonstrated, $2; (Regulations of July 18, 1913.)

Florida. The law provides for annual registration with the tax collector of the county in which the motor vehicle owners reside. The schedule of fees is as follows: Less than 10 h.p., $3;

11 to 29 h.p., $5; 30 to 40 h.p., $10; 41 to 50 h.p., $15; 51 to 60 h.p., $25; 61 to 70 h.p., $35; 71 h.p. and over, $50. Registration fees of vehicles used for hire are double the above rates.

Registration revenues are paid into the county treasury and credited to the county road and bridge fund. (Chapter No. 6212, Laws 1911.)

Georgia. The law provides for annual registration with the secretary of State. Registration fee for all motor vehicles is $5. The net revenue from registration is paid into the State treasury and credited to the State road fund. The said fund is apportioned to the several counties in the State in proportion to the number of miles of rural mail route in such counties.

County commissioners or ordinaries are required to ascertain by actual measurement the mileage of rural mail routes traveled in the county and to report same to the secretary of state. Any county misrepresenting the facts, or in which as many as 10 per cent of the motor vehicles therein are not returned for taxation, shall forfeit its right to share in the distribution of said fund for that year. (Act No. 478, Laws, 1910, as amended by Act of August 19, 1913; Act No. 431, Laws 1914.)

Idaho. The law provides for annual registration with the secretary of the State highway commission. The schedule of fees is as follows: 30 h.p. or less, $15; 31 to 40 h.p., $20; 41 to 50 h.p., $25; 51 h.p. and over, $40.00; motor cycles, $5.00; dealers and manufacturers, $35.

Registration revenues are paid into the State treasury and credited to the State highway fund for expenditure under the direction of the State highway commission. However, 70 per cent of the fees collected from the residents of any county which has issued road bonds shall be returned to such county for the payment of interest on the bonds. Fines and forfeitures are paid into the State treasury and credited to the same fund as registration revenues. (Chapter No. 179, Laws 1913.)

Illinois. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $4; 26 to 35 h.p., $6; 36 to 50 h.p., $8; over 50 h.p., $10; all electric motor vehicles, $5; motor cycles, $2; manufacturers and dealers, $15; chauffeur's license, original, $5.

Registration revenues are paid into the State treasury and credited to the State road fund for expenditure only in the construction of permanent roads. Fines and forfeitures are paid into the treasury of the road district, town or city in which collected and credited to the road fund. (Chapter No. 121, Code of 1912, as amended by Act of June 28, 1913.)

Indiana. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p.

or less, $5; 26 to 40 h.p., $8; 41 to 50 h.p., $15; over 50 h.p., $20; electric pleasure vehicles, $3; all commercial vehicles, $5; motor cycles, $2; manufacturers and dealers, $25; chauffeur's license, $2.

The net registration revenue is paid into the State treasury and credited to "a road fund" which shall be apportioned to the several counties on January 1 and July 1, of each year. Fines and forfeitures are paid into the State treasury and credited to the same fund as the registration revenues. (Chapter No. 300, Laws 1913.)

Iowa. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 20 h.p. or less, $8; each additional h.p. over 20 h.p., $.40 additional; all electric and steam vehicles, $15; motor cycles, $3; manufacturers and dealers, $15.

Eight per cent of the gross revenue is set aside in the State treasury as a maintenance fund for the State highway department. Eighty-five per cent of the gross revenue is apportioned to the several counties of the State for expenditure only for crowning, draining, dragging, graveling or macadamizing public roads outside of incorporated towns or cities. (Chapter No. 72, Laws 1911, as amended by Chapter No. 130, Laws 1913.)

Kansas. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: All motor vehicles, $5; motor cycles, $2; dealers shall register one in each class at regular rates.

The net revenue is paid into the county treasury of the county in which collected for expenditure only in maintenance of public roads. (Act of March 12, 1913.)

Kentucky. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Less than 25 h.p., $6; 26 to 49 h.p., $11; 50 h.p. and over, $20; manufacturers and dealers, one vehicle in each class, at regular rates.

Registration revenues are paid into the State treasury for the benefit of the State road fund. (Act of March 14, 1910.)

Louisiana. Annual registration of motor vehicles with the secretary of state is required, the fee being 25 cents per horse power with a minimum fee of $5. A flat fee of $2 is required for each motor cycle and $7.50 for each motor truck. The proceeds from the registration of motor vehicles is to be paid to the various parishes from which collected and apply to the construction and maintenance of roads. Non-residents are exempt if like exemption is granted residents of Louisiana. This act was submitted to a general election in 1914 and ratified and becomes effective January 1, 1915.

Maine. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 20 h.p. or less, $5; 21 to 35 h.p., $10; over 35 h.p., $15; motor trucks and commercial automobiles, $10; traction engines, $10; motor cycles, $3; operators, including owners, $2.

Registration revenue is paid into the State treasury and credited to a fund for the repair, maintenance and construction of State highways. (Chapter No. 162, Laws 1911.)

Maryland. The law provides for annual registration with the commissioner of motor vehicles at Baltimore. The registration fees are as follows: 10 h.p. or less, $5; 11 to 20 h.p., $10; 21 to 30 h.p., $15; 31 to 40 h.p., $20; and over 40 h.p., $25.00; all commercial motor vehicles $3; motor cycles $1.80; dealers and manufacturers (motor cycles, $10), $24; operators, including owners (motor cycles, $1), $2.

One-fifth of the net registration revenue is apportioned to the city of Baltimore for use on its roads and streets and the remainder shall be expended for oiling, repair and maintenance of the modern State and county roads. Fines and forfeitures are paid into the State treasury for the same use as the registration revenues.

The commissioner of motor vehicles is authorized to expend from the receipts of his office each year not exceeding $1000 for the erection of sign posts for the direction of and warning of danger to travelers. The said commissioner is also authorized to employ deputies equipped with motor cycles to enforce the motor vehicle and traffic laws of the State and pay for same in an amount not exceeding $5000 per year from the receipts of his office.

No motor vehicle in excess of 90 inches width, and no traction engine in excess of 100 inches width shall be operated on highways of State; or in which the limit of load is over 800 pounds per inch in width of tire without special permit from State roads commission, if a State road, or proper local authorities of other road. No motor vehicle of which the weight of truck and load exceeds 14 tons shall be operated on any highway.

Massachusetts. The law provides for annual registration with the State highway commission. The registration fees are as follows: Less than 20 h.p., $5; 20 to 29 h.p., $10; 30 to 39 h.p., $15; 40 to 49 h.p., $20; 50 h.p. and over $25; motor cycles, $2; all commercial automobiles and trucks, $5 for each one of one ton capacity and $3 additional for each additional ton or fraction thereof; dealers and manufacturers, $25; and $5 for each additional car over five demonstrated on the roads; dealers and manufacturers motor cycles only, $10; operators, including owners, $2. Non-residents are exempt to such an extent as the State of their residence grants exemption to residents of the State of Massachusetts. The term "non-residents" is defined to be those who have no regular place of abode or business in the State of Massachusetts for a period of more than 30 days in the calendar year.

The net registration revenue shall be expended under the direction of the State highway commission for maintenance of State highways, provided that an amount not exceeding twenty per cent of such reveune may be expended by the Commission for the repair, improvement and construction of local roads used as through routes. All fines and forfeitures are credited to the same fund as registration receipts. (Chapter No. 534, Laws, 1909, as amended to January 1, 1915.)

Michigan. The law provides for registration with the secretary of State, annually. The schedule of fees is as follows: All motor vehicles per h.p., $.50; dealers and manufacturers, not to exceed five vehicles used on the road, $50, and $10 for each additional vehicle so used; dealers and manufacturers motor cycles only, $20.

The registration revenue, after deducting five per cent for expenses, shall be paid into the State treasury for expenditure under the direction of the State highway department in addition to the regular appropriation. (Act No. 318, Laws 1909, as amended by Act No. 181, Laws 1913.)

Minnesota. . The law provided for triennial registration with the secretary of State. Registration fees are as follows: All motor vehicles, $1.50; dealers and manufacturers, one machine in each class, $10; chauffeur's license, $3.

The registration revenue is not applied to roads, but is paid to the State treasury to the credit of the general fund. (Chapter No. 365, Laws 1911.)

Mississippi. Annual registration of motor vehicles is required with the payment of the following fees: Electric motor vehicles $4.80, each commercial vehicle of 4400 pounds capacity or less $8.40, each commercial vehicle of more than 4400 pounds capacity $16.80, motor cycles $2.40, any other motor vehicle 36 cents per horse power. Fees are collected by the regular tax collector, the county board of supervisors being required to furnish him with supply of licenses. Three per cent of the proceeds are paid to the collector for making collections and the balance goes into the road and bridge privilege tax fund of the county in which collected. Non-residents are exempt for 60 days.

Missouri. The aw provides for annual registration with the secretary of State. The schedule of fees is as follows: Less than 12 h.p., $2; 12 to 23 h.p., $3; 24 to 35 h.p., $5; 36 to 47 h.p., $7; 48 to 59 h.p., $8; 60 to 71 h.p., $10; 72 h.p. and over, $12; dealers and manufacturers, $16; chauffeur's license, $1.50.

The registration revenue is paid into the State treasury to the credit of the State good roads fund, but specific appropriation by the legislature is necessary before expenditures are made. (Act of March 9, 1911, as amended by Act of January 31, 1913.)

Montana. The law provides for registration with the secretary of State. Schedule of fees is as follows: All motor vehicles, perpetual, $2; chauffeur's license, perpetual, $2.

The net registration revenue is paid into the State treasury and credited to the State highway fund, to be expended in constructing State roads and for apportionment to the several counties of the State. (Chap. No. 73, Laws 1913.)

Nebraska. The law provides for annual registration with the secretary of State, payment of fees to be made to the treasurer of the county in which the vehicle owner resides. The schedule of fees is as follows: Motor cycles, $1; all other motor vehicles, $2; manufacturers and dealers, one of each class of vehicles, at regular rates. The registration revenue is credited to the road fund of the county in which it is collected. (Chapter 115, Laws 1911.)

Nevada. The law provides for annual registration with the secretary of State. The registration fee is 12½ cents per h.p., minimum fee, $2.50. Motor cycles exempt.

The net registration revenue, when it aggregates $25,000, shall be apportioned to the several counties of the State for construction of county roads under the joint supervision of the county commissioners and the State engineer. (Chapter No. 206, Laws 1913.)

New Hampshire. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles, $3. Automobiles, 15 h.p. and less, $10; 16 to 30 h.p., $15; 31 to 40 h.p., $20; 41 to 50 h.p., $25; 51 to 60 h.p., $30; 61 h.p. and over, $40. Motor trucks, 1 ton capacity or less, $10; over one and less than two tons capacity, $12.50; over two and less than five tons capactiy, $15.00; over five tons capactiy, $20. Automobiles used for carrying passengers for hire, $10; manufacturers and dealers, $25.

The net registration revenue shall be expended in the maintenance of highways in accordance with the State highway laws, provided that 35 per cent of such net revenue may be expended in the maintenance of roads in cities, towns and places where roads are not ordinarily maintained with assistance of the State. Fines and forfeitures are paid into the State treasury for use in the same manner as registration revenues. (Chapter No. 133, Laws 1911, as amended by Chapter No. 81, Laws 1913.)

New Jersey. The law provides for annual registration with the assistant secretary of State, who is exofficio commissioner of motor vehicles. The schedule of fees is as follows: 10 h.p. and less, $4.50; 11 to 29 h.p., $7.50; 30 h.p. and above, $15; motor cycles, $2; motor trucks weighing over 4,000 pounds, in addition to regular fees, $10; dealers and manufacturers for each car demonstrated, $5; operators, including owners, for cars not exceeding 30 h.p.,

$2; operators, including owners, for cars exceeding 30 h.p., $4; motor vehicle line carrying passengers operating from and adjoining State $100.

The net revenue derived from registrations, fines and penalties shall be deposited in the State treasury for use in repairing the more important improved roads of the State, under the direction of the commissioner of public roads. (Chapter No. 113, Laws 1906 as amended to January 1, 1915.)

New Mexico. The law provides for the annual registration with the secretary of State. The schedule of fees is as follows: Less than 12 h.p., $2; 12 to 19 h.p., $4; 20 to 29 h.p., $6; 30 to 39 h.p., $8; 40 to 49 h.p., $10; 50 h.p. and over, $12; dealers and manufacturers, $12.

The net registration revenue shall be paid into the State treasury and credited to the State highway fund for expenditure upon the public highways of the State, preference being given to automobile routes. (Chapter No. 19, Laws 1913.)

New York. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $5; 26 to 34 h.p., $10; 35 to 49 h.p., $15; 50 h.p. and above, $25; all motor vehicles used for commercial purposes only, $5; dealers and manufacturers, $15; chauffeur's license, $5; motor cycles exempt.

The revenue derived from registrations, fines and forfeitures is paid into the State treasury for appropriation to be used for maintenance and repair of improved roads of the State under the direction of the State highway commission. (Chapter No. 374, Laws 1910, as amended in 1911.)

North Carolina. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $5; 26 to 40 h.p., $7.50; 41 h.p. and over, $10; motor cycles, $2; manufacturers and dealers, $10.

The registration revenue shall be paid into the State treasury and a separate account kept of it. On July 1, of each year, 80 per cent of such revenue shall be returned to the county from which collected for expenditure upon the public roads of such county and for no other purpose. (Chapter No. 107, Laws 1913.)

North Dakota. The law provides for annual registration with the secretary of State. The registration fee for all motor vehicles is $3.

The net registration revenue is returned to the county from which collected for expenditure for repairs and maintenance of the main traveled roads of the county, provided that no part of said funds shall be expended within the limits of an incorporated town or city, nor within any township that does not levy a road tax of at least 6 mills on the dollar of assessed valuation. (Chapter No. 6, Laws, 1911.)

Ohio. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles, $2.00; electric motor vehicles, $3.00; gasoline and steam motor vehicles, $5.00; dealers and manufacturers, motor cycles, for each make manufactured or dealt in, $10.00; dealers and manufacturers, other vehicles, for each make manufactured or dealt in, $20.00; chauffeur's license, motor cycles, $1.00; chauffeur's license, all other motor vehicles, $3.00.

The net revenue derived from motor vehicle registrations shall be paid into the State treasury and one-third of the same shall be used for the repair, maintenance, protection, policing and patrolling of public roads and highways. The remaining two-thirds of the net revenue goes into the general fund of the State. (Chap. 21, Code 1910, as amended to January 1, 1915.)

Oklahoma. The law provides for annual registration with the State highway department. The registration fee for automobiles is $1.

The registration revenue shall be used to create a fund for the maintenance of the State highway department. (Chapter No. 105, Laws 1911.)

Oregon. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 26 h.p. and less, $3; 27 to 36 h.p., $5; 37 to 40 h.p., $7.50; over 40 h.p., $10; electric pleasure vehicles, $3; electric commercial vehicles, $5; motor cycles, $3; chauffeur's license, $2; manufacturers and dealers, $10.

The net balance of registration revenues on December 31 of each year is returned to the county treasurer of the county from which collected to be credited to the general road fund. Fines and forfeitures are also paid to the county treasury to be credited to the general road fund. (Chapter No. 174, Laws 1911, as amended by Laws of 1913.)

Pennsylvania. The law provides for annual registration with the State highway department. The schedule of fees is as follows: Less than 20 h.p., $5; 20 to 34 h.p. $10; 35 to 49 h.p., $15; 50 h.p. and over, $20; motor cycles, $3. Motor vehicles with solid tires, less than 4,000 pounds gross, $5; 4,000 pounds and less than 5,000 pounds gross, $10; 5000 pounds and less than 10,000 pounds gross, $15; 10,000 pounds and less than 15,000 pounds gross, $20; 15,000 pounds and not over 24,000 pounds gross, $25; not licensed over 24,000 pounds. Chauffeur's license, $2; dealers and manufacturers for each pair of number tags, $10.

Registration revenue is paid into the State treasury to be available for expenditure in assisting in the construction, maintenance, improvement and repair of State highways and State aid highways. Fines and forfeitures imposed for violation of the provisions as to speed and weight shall be paid into the treasury of the city, borough, town or townships in which such violations occur for expenditure in construction, maintenance and repair of the highways thereof. Other fines and forfeitures are paid into the State treasury for use in the same manner as registration revenues. (Act No. 385, Laws 1913.)

Rhode Island. The law provides for annual registration with the State board of public roads. The schedule of fees is as follows: 20 h.p. or less, \$5; 21 to 30 h.p., \$10; 31 to 40 h.p., \$15; 41 h.p. and over, \$25; all commercial vehicles, \$7; motor cycles, \$1; dealers and manufacturers, \$50; operators, including owners, \$1.

The revenue derived from registrations, fines and forfeitures is paid into the State treasury to be used for the repair and maintenance of State roads under the direction of the State board of public roads. (Chapter No. 86, Laws 1908, as amended to January 1, 1915.)

South Carolina. The law provides for registration with the clerk of court of the county in which the owner resides. Registration for all motor vehicles is \$1. No general provision is made for distribution of the revenue from registrations except that in 1914 an act was passed for Oconee County providing that the proceeds of registering motor vehicles therein, after deducting 5 per cent commission for collection, should go into the general road fund of the county. (Act No. 55, Laws 1906, as amended to January 1, 1915.)

South Dakota. The law provides for annual registration with the secretary of State. The application for registration shall be filed with the county treasurer and the payment of fees made to him. The schedule of registration fees is as follows: Automobiles, \$6; motor cycles, \$2.

Twelve and one-half per cent of the gross revenue is transmitted to the secretary of State with the application to be expended in payment of costs in connection with registration. Eighty-seven and one-half per cent of the gross revenue shall be retained by such county treasurer for expenditure only in grading, crowning, draining, dragging, graveling or macadamizing public highways of the county under the direction of the board of county commissioners. (Chapter No. 276, Laws 1913.)

Tennessee. The law provides for registration with the secretary of State. The registration fee (perpetual) is \$2. The State registration certificate shall be recorded with the clerk of the county in which the vehicle owner resides, for which a fee of \$1 may be charged. The law makes no provision for the disposition of the registration revenues. (Chapter No. 173, Laws 1905.)

Texas. The law makes provision for registration with the Clerk of the County in which any motor vehicle owner resides. The registration fee (perpetual) is 50 cents.

The revenue from registrations apparently goes to the clerk making the registration. (Chapter No. 96, Laws 1907.)

Utah. The law provides for registration with the secretary of State. The registration fees (perpetual) are as follows: All motor vehicles, $2; chauffeur's license, $2.

The registration revenues are paid into the State treasury and there credited to the State road fund to be expended under the direction of the State highway department. (Chapter No. 113, Laws 1909.)

Vermont. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: First registration, per h.p., $1; second registration, per h.p., 75 cents; third and subsequent registrations, per h.p., 50 cents; operators, including owners, $2.00; manufacturers and dealers, $25.

The net registration revenue is paid into the State treasury to be expended for the repair and maintenance of main thoroughfares and State roads under the direction of the State highway commissioner. (Chapter No. 176, Public Statutes of 1906, as amended to January 1, 1915.)

Virginia. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 20 h.p. and less, $5; 21 to 44 h.p., $10; 45 h.p. and over, $20; motor cycles, $2; manufacturers and dealers, $50; chauffeur's license, $2.50.

The net registration revenue is paid into the State treasury to be credited to a special fund for expenditure in permanent improvements of the main highways of the State, under the direction of the State highway commissioner and in accordance with the State aid highway act of 1908. (Act of March 17, 1910.)

Washington. The law provides for annual registration with the secretary of State. The registration fee is $2.

The law makes no special provision for the disposition of the registration revenue. (Chapter No. 154, Laws 1905.)

West Virginia. The law provides for annual registration with the State auditor. The fee for motor vehicle registration is $10. Chauffeur's license (perpetual) $2. The registration revenue is not applied to roads but goes into the general fund of the State. (Chapter No. 32, Code of 1906, as amended to January 1, 1915.)

Wisconsin. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles $2; all other motor vehicles $5; dealers and manufacturers, for each garage, $5.

Three-fourths of the net registration revenue is returned to the county from which collected at the end of each year, same to be expended in repairing highways outside of incorporated towns and cities. The remaining amount of such revenue shall be credited to the State highway fund in the State treasury. (Chapter No. 600, Laws 1911.)

Wyoming. The law provides for annual registration of automobile with the secretary of State. The registration fee is $5.

Four dollars of each registration fee paid is returned to the county treasurer of the county from which received, and shall be credited to a special fund for expenditure only for temporary improvement of the county roads. The remaining one dollar of such registration fee is retained by the secretary of State for the payment of expenses incident to such registration. (Chapter No. 95, Laws 1913.)

TYPES OF ROADS

Earth Roads

The importance of earth roads is indicated by the fact that of the approximate mileage of 2,200,000 in the United States, 2,000,000 are classed as earth roads. The work in the future upon earth roads should contemplate (1) proper drainage, (2) reduction of grades, (3) improvement of alignment, (4) betterment of the road surface.

Proper Drainage.—The prevailing defect in earth roads is poor drainage and this defect is the first one which should be remedied. Drainage is for two purposes, first to remove water which reaches the surface of the road by precipitation or otherwise and, second, to remove under ground water which reaches the road from adjacent land or through the top surface. Surface drainage is accomplished by securing a reasonably firm crowned traveled roadway and by providing broad shallow ditches of good alignment and uniform grades and with ample outlets. Subdrainage to remove water from beneath the road surface or to prevent its presence in the roadbed is accomplished most effectively by socalled blind drainage or French drains or special sub-side-drains. There are also other methods. These methods include center subdrains or V-shaped drains or sometimes rock bottoming in the form of a rough telford construction. The best side-drains consist of a trench 3½ feet deep, 15 inches wide at the top, in which is laid an open bell joint glazed tile 4 to 6 inches in diameter with the bells up hill and the trench back filled with broken stone or coarse gravel. The main purpose of these drains is to intercept ground water. The joints of the pipes should be left open and the drains should lead into a proper outlet so that the water may go entirely away from the road. One such drain upon the up-hill side of a road will frequently remedy the worst conditions due to the presence of water. The V-drain consists of a shallow V-shaped trench under the entire traveled way which is back filled with field stones or cobbles. Such construction requires considerable excavation but is somewhat cheaper than two side-drains. The excavation must be 12 to 18 inches deep at the center and 6 to 8 inches deep at the edges. It should be back filled with stones ranging from 6 to 10 inches in diameter with the largest in the bottom. To dispose of water collected by this drain, trenches should be dug about every 50 feet and back filled with stone. These trenches should lead entirely away from the road so it is seen that this construction is mainly available for either roads located over fills on boggy land or on side-hills when the outlets will of course be on the down hill side only. Subdrainage should not be undertaken without proper lines and grades furnished by an engineer as it is expensive and if properly put in would constitute sufficient drainage for any subsequent improvement of the road by macadamizing or otherwise.

Returning to the matter of surface drainage, the earth road should be kept free from ruts by the use of the road drag or otherwise and a crown of 1 inch to the foot should be preserved. Water is thus shed toward the sides. The side ditches collect surface water and must be kept free. On heavy grades they will tend to wash and may require paving in the worst cases. The wash may usually be prevented by providing sufficient outlets to reduce the volume of water. A common defect in earth roads is failure to provide side-drains to discharge water away from the roads Surface drainage is greatly hampered and interfered with by driveways leading into private grounds. Raised drive-ways across open gutters divert the water into the center of the road and unfortunately in most instances where tiled drains have been placed, they have become broken or clogged and every considerable rain storm threatens the destruction of a portion of the roadway. The only point where such a drive-way is safe is at the top of a grade. Even when drive-ways are provided with under drains it is common to find that the drainage of the drive-way itself runs into the road. Surface drainage then upon earth roads demands fearless treatment of the drive-way problem. It would probably pay in most instances to pave the bottom of the gutter where the drive-way crosses it and leave the side drainage free.

When it becomes necessary that drainage water cross the road, ample culverts must be provided. The worst fault common to culverts is that they rapidly become clogged with leaves or other rubbish. They should therefore be of more than sufficient size in the first instance. When less than from 2 to 3 feet of earth cover tile pipe, it is liable to become broken. The prevalent defect on earth road construction in the matter of culverts is that they are too small and too near the surface. It will pay even in earth road construction to install more expensive culverts in the first instance rather than to rip them up for repairs at frequent intervals.

Grade and Alignment.—The worst grade on any road is the effective limitation of traffic. After a grade exceeds a rise of 6 feet in the hundred it is serious. Grades may be avoided or reduced either by relocation in part or by excavation and embankment. The best treatment of earth roads in the matter of grades is to establish once and for all a definite, permanent grade with the engineer's level. It need not follow that the entire road is to be graded but with the grade line in mind the worst hills may be cut down and the worst hollows filled up and year by year the entire road will progress toward a final and satisfactory profile. Much money has been wasted by not adopting such a grade line at the outset. In the matter of relocation it is, of course, impossible for a road well established in the community to be entirely changed or abolished in most cases. Grade improvement may have to be brought about by relocating smaller portions of earth roads. Here, again, the services of a surveyor or experienced road supervisor with a transit will prove economical in the end. Some necessary relocation may be undertaken each year. In reducing grades or relocating for earth roads, it is not necessary that all cuts and fills should balance as excess of material may always be used to widen fills and a deficiency of material can usually be supplied by widening the cuts. In the matter of roads over rocks or ledges, it is cheaper to fill up hollows with borrowed earth than to undertake excessive rock cutting. In constructing or repairing an earth road, it is quite common to use the scraping grader or road machine. Where work with this machine is undertaken the width of the road between gutters should be determined. It is a common fault to to find earth roads too wide. Twenty-four feet between gutter lines is ample for a road which a community is not warranted in improving by macadamizing or otherwise hardening its surface. Frequently 20 or 18 feet is a sufficient width. With the width between gutters in mind, a line of stakes should be set before the grader begins its work. The line of stakes along each gutter will improve the work of the grader and leave gutters which will not tend to cause wash into the road.

Surface Betterment.—When it is desired to spread new material upon an earth road care should be taken to secure it from the best available supply. It is not good practice to place gravel in patches upon an earth road to fill hollows. Materials should be spread uniformly upon the traveled way and should be applied for a considerable distance and the ends of the application should be reduced in depth gradually so as not to form a new chuck hole. The object of the scraping grader is to simultaneously construct gutters or side-drains and place material for a crown in the center.

Right here is opportunity for a great improvement in earth road work. Sod, leaves, vegetable matter and rotted material of any description can never form a road surface. There are two ways of using the grader. It may be operated at first to cut the surface only and scrape all perishable material into ridges which are later carted away or the grader may be run regardless of sod and other poor material and men with rakes and forks can then follow it and remove all objectionable matter into dump wagons. Old roads are frequently in such condition that it is better to scrape the shoulders and gutters away from the center and remove the entire mass. Frequently this operation alone will result in a well established and crowned roadway with live material for its surface.

Conclusion.—The earth road problem today is a problem of repair and maintenance. No earth road will endure travel without constant care. The use of the split-log drag which is described in the paragraph upon maintenance is the best method for preserving road surfaces and establishing proper surface drainage from the traveled way to the side ditches. Earth road repairs will become unnecessary in proportion to the increased care in road maintenance. It cannot, however, be expected to start any maintenance upon an earth road until it is put in reasonable repair. The repair should follow the lines indicated above, that is to say, earth road repair should include some permanent drainage work, the reduction of some of the worst grades, the straightening of bad curves and the betterment of the road surface by the removal of worn out and objectionable material.

Sand-Clay Roads

A sand-clay road is composed of sand and clay mixed in such proportions as to form a compact and firm support to traffic. The perfect sand-clay road should be neither sticky nor sandy. The sand and clay may form a natural mixture, in which case the road is termed a "natural sand-clay road." The two materials may have become mixed in the fields along the road by successive cultivation of soil, and this soil known as "top soil" is sometimes used in road construction.

There are many varieties of both sand and clay, consequently there is a wide variation in the characteristics of a sand-clay road. Sand while one of the hardest minerals known, possesses practically no binding or cementing power. The grains of sand instead of cohering in a tough mass under the impact of traffic and the action of water, remain loose and shifting. No road is so difficult to travel as the road located through fine sand, and the difficulties are enormously increased when high winds prevail.

Clay is a decomposition product of the mineral feldspar. If the clay has been carried by water the deposit is known as "sedimentary clay." If the feldspathic rock has disintegrated in place, the product is known as "residual clay." The sedimentary clays are in general more sticky and plastic than the residual clays. In contrast with sand, which possesses no binding power but is very hard, clay is a powerful binder, but does not possess the quality of hardness. It is evident that in the construction of a sand-clay road the sand must furnish the quality of hardness amd resistance to wear while the clay must furnish the quality of toughness and bind the individual sand grains firmly together.

The theory of the sand-clay road is very similar to the theory of the macadam road. In the latter, rock dust and screenings fill the voids between the angular fragments of stone and when wet serve as a cement or binder. The grains of sand may be likened to the angular fragments of stone and clay to the rock dust binder. In the most successful sand-clay road, just a sufficient amount of clay is used to fill the voids between the grains of sand. In this way, the sand sustains the wear, while the clay serves as a binder. If too much sand is used, the result will be loose sand on the surface; if too much clay is used, the surface of the road will become sticky after rains.

The best mixture of sand and clay can be made when the materials are wet, and particularly is this true of the "ball clays." The more water that is used, the better the mixture, and if practicable, the materials should be puddled. A disk harrow may be used to advantage.

The extent to which the mixing can be carried on will depend largely upon the character of the clay. If it is a very plastic clay, much greater effort will be necessary to obtain a complete mixture; if, on the other hand, it is a slaking clay, the mixing will be much less difficult. Slaking clays are not as satisfactory, however, as the ball clay, as their binding powers are much less. In selecting clay for road purposes, it is always best to select the stickiest clay available. A common test is to wet the thumb and place it against a piece of clay. If the clay sticks to the thumb, it is reasonable to suppose that it will stick to the sand; if it will not stick to the thumb, it is safe to assume that it will be a poor binder in a sand-clay road.

If the clay is placed on sand to a depth of 6 inches, a cubic yard of clay will cover 54 square feet, consequently a 16-foot road treated in this manner would require about 1 cubic yard of clay for each 3 feet of length. A mile of 16-foot road would, therefore, require 1760 cubic yards of clay. The amount that can be hauled by the average team varies from two-thirds to 1 cubic yard, according to the character of the road over which the hauling is done.

If the clay sub-soil is to be treated with sand, it should be plowed and harrowed to a depth of about 4 inches. On this prepared sub-surface should be placed from 6 to 8 inches of clean sand, spread thickest at the center and sloping to the sides in much the same manner as the clay is applied to a sand road. These materials should then be mixed dry instead of the wet mixing, which is preferable when clay is applied to sand. This is preferable, because the clay can be better pulverized when in a dry state. After the dry mixing, the road should be heavily sprinkled or should be puddled after the first heavy rain. After the materials are thoroughly mixed and puddled, a road machine or grader should be used to give proper crown to the road, and if a roller is available the road can be improved by the use of it. As it is impossible to determine exactly the proportions of sand and clay to be used in the first place, it is necessary to give careful attention to the sand-clay road for a considerable time after it is completed, in order that additional sand or clay may be applied as needed.

Gravel Roads

There are three important qualities which should be possessed by road-building gravel—hardness, toughness, and cementing or binding power. Of these three qualities, the last is the most important. This binding quality is due in part to the presence of oxide of iron, lime, or clay, and in part to the angular shape and size of the pebbles composing the gravel. Blue gravel is generally conceded to be the best for road construction, because it is usually derived from trap rock. As the pebbles composing the gravel retain the characteristics which they formerly possessed as a part of the larger rock itself, it follows that as trap rock is considered an excellent material for road building, trap rock gravel should occupy the same relative rank among the gravels. Quartz possesses practically no binding power, although it is very hard. Therefore, gravel which contains an exceptionally large percentage of quartz will not prove successful, as it will fail to consolidate unless it contains binding material, or unless a good binder is added. This, however, is not true of the chert gravels which bind and consolidate very well forming excellent roads.

The shape and size of the pebbles composing the gravel have an important bearing upon its value as a road material. In order that the material may bond readily, the pebbles should be angular and should vary in size so that the smaller fragments may fill the voids between the larger pieces. Gravel obtained from streams is usually inferior to pit gravel for the reason that the action of the water has worn the pebbles smooth and practically all the fine binding material has been removed by the same agency. Even if clay or loam is mixed with river or creek gravel, the result is not likely to be as satisfactory as that obtained by the use of pit gravel. Pit gravel frequently contains too much clay or earthy matter, while river gravel may have too much sand. In such cases it is advisable to screen the gravel so as to eliminate the material which is too fine and that which is too coarse. The screen should be similar to that which is used in preparing material for a macadam road. In the handling of the gravel care should be exercised not to separate the binding material from it, nor should this binding material be allowed to settle to the bottom in spreading the material over the road surface. It will often be found advisable to spread a thin layer of such binding material over the surface after the material has been distributed and rolled, and after this the surface should be sprinkled and rolled again, or else rolled while still damp from the rains.

When the gravel, especially that which is to constitute the surface layer, contains large pebbles, these should be removed and either thrown aside or else raked into the foundation or recrushed. At least 60 per cent by weight of the gravel should be pebbles above one-eighth inch in size, and there should be no pebbles in the bottom layer that will not pass through a 2½-inch or 3-inch ring, and in the top layer there should be no pebbles which will not pass through a 1½-inch ring. Not over 20 per cent of the mass should be clay, and this should be uniformly mixed and should contain no large lumps. Ten or 15 per cent of clay produces better results than 20 per cent. If the foundation or road bed is loose, it should be carefully rolled. It is quite as important to have a solid foundation for a gravel road as for a macadam road. Gravel will compact to about 80 per cent of its depth, loose measure. If the compacted depth of the gravel road is to be 8 inches and the width 12 feet, it will take about 2250 cubic yards of gravel to the mile, and it is best to make the first layer about 6-inches in depth, loose measure, and the second layer about 4-inches in depth, loose measure.

Gravel should not be dumped directly on the road, as this will usually result in a rough, uneven surface. A carefully staked out sub-grade or "box" with earth shoulders is necessary. The sub-grade should be rolled. If specially devised spreading wagons are not used, the gravel should be dumped on boards and spread from them on to the road. The gravel should be placed on the road commencing at the end nearest the gravel pit in order that the teams may aid in packing the material.

Each layer of gravel should be rolled separately with a power roller; the rolling should begin at the sides and continue toward the center until the surface is thoroughly compacted. The surface layer should be sprinkled while the rolling is in progress, but if a roller and sprinkler are not available, the road should be constructed during the wet season of the year, as the rains will cause the material to pack much better than if the road were built during the dry season.

The split-log drag, or some similar device, can be used to advantage in maintaining gravel roads but it will be necessary to use hand rakes to remove excessively large stones which appear on the surface. New gravel must be uniformly spread from time to time.

Macadam Roads

The macadam road takes its name from John L. Macadam, whose biography appears in this volume. The word *macadam* denotes a surfacing composed of angular broken stone bound together, whose voids are filled with stone screenings flushed with water, and which is consolidated by rolling, into a practically impervious crust, superposed on a thoroughly compacted foundation or subgrade. Both the exposed surface and the subgrade have a crown or slope from center to sides.

A good macadam road should have (1) proper location, (2) easy grades, (3) perfect drainage, (4) firm subgrade or foundation, (5) broken stone with good wearing and bonding properties and (6) careful inspection during the construction. Proper location and easy grades are more essential for macadam roads than for less expensive types of roads for the reason that unless right at the outset they cannot be changed without extraordinary expense.

Perfect Drainage.—Drainage must remove water from the road surface and the foundation and carry it entirely away from the road. The properly completed macadam surface sheds water into broad open side ditches by virtue of the road crown. The side ditches may have to be paved upon steep grades especially where they carry considerable water from adjacent land. When ditch water must cross the road, catch basins are usually necessary and ample culverts should be provided of first class construction (see article on culverts). To drain the road foundation or subsoil, side-drains with tiled pipe and stone back fill are most effective. Where considerable field stone is present a shallow so-called V-drain forming the entire subgrade is cheaper than two side-drains and equally effective in providing sub-drainage. The V-drain filled with stone not greater than from 8 to 10 inches in diameter with the larger stones at the bottom, should be brought to the true crown and rolled and it should have frequent outlets entirely away from the road. When properly built, the V-drain offers an excellent foundation for the macadam surface. In particularly damp or boggy spots a telford foundation or bottoming course of hand laid stone not less than 6 inches in depth is sometimes used. Modern practice, however, seems to favor either the sub-side-drain or the V-drain construction for drainage purposes. Sub-drainage is usually required in heavy cuts on hillside roads and for roads over swampy land.

Subgrade.—After a road has been properly graded and the permanent drainage structures completed, the subgrade must be built. In cuts through firm soil, the subgrade is formed by simply excavating a trench of width and depth equal to the width and depth of the compacted stone surfacing. Spongy material wherever encountered must be removed and replaced by good live earth or gravel. Where loose dry sand is encountered, the utmost care is necessary to prevent the sand from churning into the first layer of broken stone when rolling commences. In fills if the earth has been deposited in layers and subjected to teaming, the subgrade trench or box may be excavated and afterwards thoroughly rolled. Care must be taken to insure that the subgrade is thoroughly solid and it must not wave under the roller. Material excavated from the subgrade is piled along the sides or shoulders to form earth abutments to prevent spreading of the macadam when it is rolled. Too much care and refinement cannot be given to the subgrade or foundation for the macadam. It should invariably be rolled to a true firm surface, clean and without ruts and with perfect crown. There will then be no waste of stone or churning of earth into the lower course to weaken the macadam and the tendency of the finished road to form holes will be largely avoided.

Broken Stone.—Trap rock is the best road stone for plain macadam or "waterbound" macadam construction. It is frequently desirable, however, to use local stone and the Office of Public Roads, U. S. Department of Agriculture, will test stone samples from any locality in this country free of charge. This Office has published complete tables showing the relative merits of nearly all road stones. Road stone should (1) be hard enough to wear well, (2) so tough that the roller does not crush it, (3) and possess bonding qualities to form a smooth unyielding surface. Road stone is usually placed in two courses; the first course ordinarily consists of stones varying in size from 3 to 1½ inches in greatest diameter. The softer stones may be somewhat larger than the denser or tougher material. Ordinarily a roller cannot compact more than 6 inches of loose stone successfully and it is customary for the first course to be rolled separately. The stone is spread either from spreader wagons or from dumping boards. Careless dumping of the stone directly upon the subgrade in piles will result in an uneven finished surface. The first course is sometimes called the no. 1 stone. It is thoroughly rolled with a steam roller until walking does not loosen the stones. Teams hauling stone over the subgrade should guard against cutting ruts or churning the stone in the subgrade soil. Upon the rolled first course, a second course of stone varying in size from 1½ to ¾ inches in diameter is placed to a depth of about 3 to 5 inches in a manner similar to the first course. When the second course stone has been rolled until its surface is smooth and the individual stones are well keyed together and no creeping or wavering appear before the front wheel of the roller, the bonding process commences.

Careful Inspection.—Bonding of a macadam road is accomplished by completely filling the voids in the broken stone with fines or screenings from the crusher. The process of binding or bonding requires the greatest care. The fines or screenings or stone dust should be worked in the road *gradually*. To accomplish this, the screenings are spread in thin successive courses with alternate wetting by a sprinkling wagon and continuous rolling. Care should be taken that wagons drawing screenings should not cut up the partially built road. When the voids are completely filled mud will flush to the surface in front of the roller and the bonding is complete. If the macadam is well bonded, the road is now strong enough to withstand the kick of a boot-heel.

The width and depth of macadamized surfaces are governed by local conditions. A one-way road may be as narrow as 8 feet. The general practice is to build macadam surface from 14 to 16 feet in width. The thickness of the macadam surface is determined somewhat by the traffic conditions and varies from 5 to 8 inches when complete. Loose broken stone is usually estimated to consolidate from one-fourth to one-third under rolling.

A newly built or green macadam road will sometimes immediately show tendency to ravel particularly if the second course stone is trap rock. This raveling usually cures itself but if it continued, removal of the larger loose stones and additional rolling may be necessary.

Qualities of Macadam Road Material

"Uniform specifications for crushed stone for macadam construction are in a measure impracticable, owing to the necessity of meeting local conditions in the selection of the stone. The following table, showing maximum and minimum results of tests made by the U.S. Office of Public Roads on rock samples, embracing a large number of specimens of stone from various sections of the country, will afford the engineer an intelligent idea as to the standards to which stone should conform in order to be usable."

Bituminous Macadam Roads

The term "bituminous macadam"[47] was introduced about the year 1906 to designate a macadam road, for which some form of bituminous material was used as a binding agent and to form a

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[47] In justice to those who claim that the term "Bituminous Macadam" should be used in a much more restricted sense the following definition from the Report of the Sub-Committee on Bituminous Paving Nomenclature of the American Society of Municipal Improvements is given.

(3) Bituminous macadam is a pavement consisting principally of crushed stone and retains its integrity of structure mainly by the mutual support of the various particles of stone, aided by the slight bonding value of the fine mineral matter in its composition, and which is protected from surface dis-

Maximum and Minimum Results on Rock Samples, Corrected to January 1, 1914

NO. OF SAMPLES	NAME	SPECIFIC GRAVITY			WEIGHT—POUNDS PER CUBIC FOOT			WATER ABSORBED—POUNDS PER CUBIC FOOT		PER CENT OF WEAR		FRENCH COEFFICIENT OF WEAR		HARDNESS		TOUGHNESS		CEMENTING VALUE		NAME
		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
22	Amphibolite	3.15	2.75	3.02	196	172	189	1.65	0.04	10.3	1.5	41.7	3.9	19.0	13.5	40	7	235	3	Amphibolite.
66	Andesite	2.95	1.85	2.66	184	115	166	12.50	0.05	17.4	1.4	28.6	2.3	19.4	5.0	44	5	500	9	Andesite.
208	Basalt	3.15	2.30	2.85	193	143	178	6.40	0.02	16.6	1.3	30.4	2.4	19.3	5.7	47	5	500	2	Basalt.
64	Chert	3.00	2.00	2.55	187	125	158	11.10	0.25	29.2	2.7	14.9	1.4	19.7	12.7	26	5	500	2	Chert.
12	Conglomerate	2.75	2.50	2.60	172	156	162	3.31	0.36	26.8	3.5	11.6	1.5	18.4	9.3	10	10	500	4	Conglomerate.
276	Diabase	3.20	2.65	2.94	200	165	185	2.73	0.04	6.3	1.1	36.4	6.4	19.4	12.3	54	4	500	2	Diabase.
84	Diorite	3.35	2.70	2.87	209	168	179	1.03	0.05	12.0	1.7	23.8	3.3	19.4	16.6	38	4	164	5	Diorite.
364	Dolomite	3.00	2.30	2.72	187	143	173	9.40	0.07	22.5	1.2	33.3	1.8	18.8	1.8	27	2	179	8	Dolomite.
19	Eclogite	3.70	2.95	3.15	231	184	196	0.28	0.05	2.9	1.8	22.7	13.8	18.8	17.4	31	14	130	10	Eclogite.
13	Epidosite	3.30	2.70	3.00	206	168	187	1.66	0.22	7.4	2.0	19.6	5.4	19.5	10.7	29	18	83	3	Epidosite.
12	Felsite	2.85	2.50	2.65	178	156	165	3.13	0.02	3.4	1.9	21.3	11.8	18.7	18.7	16	16	101	2	Felsite.
91	Fieldstone	......	......	......	......	......	......	......	......	10.3	2.1	19.0	3.8	......	......	......	......	......	......	Fieldstone.
48	Gabbro	3.65	2.75	2.97	228	172	185	2.62	0.04	5.9	1.3	30.8	6.8	18.8	13.3	23	6	134	6	Gabbro.
209	Gneiss	3.20	2.60	2.76	200	162	172	1.28	0.02	16.4	1.7	29.0	2.4	19.3	9.0	26	2	209	1	Gneiss.
280	Granite	3.00	2.00	2.66	187	125	166	3.00	0.04	24.6	1.1	37.0	1.6	19.6	13.6	33	2	255	2	Granite.
247	Gravel	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	500	3	Gravel
954	Limestone	2.85	2.00	2.67	178	125	166	13.22	0.02	34.2	1.8	21.7	1.2	19.2	0.0	25	2	500	8	Limestone.
63	Marble	2.90	2.65	2.77	181	165	173	2.19	0.06	27.0	2.3	17.5	1.5	17.3	4.5	23	2	85	9	Marble.
15	Marl	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	500	6	Marl.
19	Mixed stone	......	......	......	......	......	......	......	......	10.3	2.1	19.1	3.9	......	......	......	......	......	......	Mixed stone
5	Peridotite	3.55	2.65	2.95	221	165	184	1.02	0.27	5.3	3.0	13.2	7.6	15.0	13.3	12	9	91	25	Peridotite.
128	Quartzite	3.15	2.35	2.69	196	147	174	2.95	0.04	7.6	1.6	24.5	5.3	19.7	15.3	58	4	200	0	Quartzite.
45	Rhyolite	2.90	2.05	2.56	181	128	160	7.15	0.03	9.7	1.7	24.1	4.1	19.7	15.3	42	6	500	5	Rhyolite.
443	Sandstone	3.25	1.90	2.61	203	123	163	14.00	0.07	41.7	1.0	40.8	1.0	19.5	0.0	60	2	500	1	Sandstone.
187	Schist	3.20	2.50	2.89	200	156	183	1.87	0.06	23.3	1.3	31.7	1.7	19.0	0.9	44	3	232	5	Schist.
15	Shale	2.75	2.50	2.68	172	156	167	4.80	0.50	11.8	3.2	12.6	2.5	17.7	13.9	12	3	368	28	Shale.
66	Slag	3.90	2.00	2.91	243	125	183	4.90	0.04	19.1	2.5	15.7	2.1	18.3	9.5	21	2	500	1	Slag.
80	Slate	3.80	2.40	2.77	209	150	172	3.41	0.05	17.1	1.6	24.4	2.3	19.7	1.1	56	1	255	1	Slate.
80	Syenite	3.05	2.15	2.74	190	134	171	3.06	0.09	14.4	1.6	25.6	2.8	19.2	17.3	22	8	257	2	Syenite.
1	Travertine	2.70	2.70	2.70	168	168	168	0.065	0.065	5.9	5.9	6.8	6.8	12.0	12.0	4	4	24	24	Travertine.

EXPLANATION OF RESULTS GIVEN IN TABLE

RESISTANCE TO WEAR

Resistance to wear is a special property in a rock, and although it depends to a large extent upon both the hardness and the toughness of the rock it is not an absolute function of these qualities.

The per cent of wear in the table refers to the dust and detritus below one-sixteenth of an inch in size worn off in the abrasion test. The test is made in the following manner: Eleven pounds (5 kg.) of broken rock between 1½ and 2½ inches in size, 50 pieces if possible, are placed in a castiron cylinder mounted diagonally on a shaft and slowly revolved 10,000 times.

The French coefficient of wear is obtained by dividing 40 by the per cent of wear. Thus a rock showing 4 per cent of wear has a French coefficient of wear of 10. The French engineers, who were the first to undertake road-material tests, adopted this method of recording results. They found that their best-wearing rocks gave a coefficient equal to about 20. The number 20 was therefore adopted as a standard of excellence. In interpreting the results of this test a coefficient of wear below 8 is called low; from 8 to 13, medium; from 14 to 20, high; and above 20, very high. Rocks of very high resistance to wear are suited only for heavy traffic.

HARDNESS

By hardness is meant the resistance of a rock to the grinding action of an abrasive agent like sand, and it is tested as follows:

A core 1 inch in diameter, cut from the solid rock, is faced off and subjected to the grinding action of sand fed upon a revolving steel disk against which the test piece is held with a standard pressure. When the disk has made 1,000 revolutions the loss in weight of the sample is determined. In order to report these results on a definite scale which will be convenient the method has been adopted of subtracting one-third of the resulting loss in weight in grams from 20. Thus a rock losing 6 grams has a hardness of 20—6/3, or 18. Experience has shown this to be the most convenient scale for reporting results. The results of this test are interpreted as follows: Below 14, rocks are called soft; from 14 to 17, medium; above 17, hard.

TOUGHNESS

By toughness is meant the resistance a rock offers to fracture under impact; such, for instance, as the striking blow given by a shod horse. This property is tested in a specially designed machine built on the pile-driver principle, by which a standard weight is dropped upon a specially prepared test piece until it breaks. The height in centimeters of the blow which causes the rupture of the test piece is used to represent the toughness of the specimen. Results of this test are interpreted so that those rocks which run below 13 are called low; from 13 to 19, medium; and above 19, high.

CEMENTING VALUE

By cementing value is meant the binding power of the road material. Some rock dusts possess the quality of packing to a smooth, unpervious mass of considerable tenacity, while others entirely lack this quality. Cementing value should not be confused with the property possessed by Portland cement, which causes it to set into a hard, stone-like mass when mixed with water. The cementation test is made as follows:

The rock sample is ground in an iron ball mill with sufficient water to form a stiff, fine-grained paste. From the paste small briquettes 1 inch (25 mm.) in diameter and 1 inch high are molded under pressure. After thorough drying the briquettes are tested under the impact of a small hammer which strikes a series of standard blows. The number of blows required to destroy the briquette is taken as a measure of the cementing value of the dust. Some rock dusts, when thoroughly dried into compact masses, immediately slake or disintegrate when immersed in water. It is considered that the tendency to act in this way is not a desirable characteristic of a road material, as it would lead to muddy conditions on the road surface after rains. The test is interpreted so that cementing values below 10 are called low; from 10 to 25, fair; from 26 to 75, good; from 76 to 100, very good; and above 100, excellent.

WEIGHT PER CUBIC FOOT

The weight per cubic foot refers to the weight of the material in the form of a solid and not as broken stone.

surface coat. The desirability of changing from the original type of what is now called "waterbound macadam" was brought about unquestionably by the action of increasing automobile traffic. When the presence of automobiles of various types and speeds became general on macadam roads, it was found (1) that more or less dust was raised from the surface by the passing automobile and that this dust usually was carried away from the road; (2) that the surface of the dry macadam road soon raveled and in the worst conditions completely disintegrated; (3) that it was too expensive to water macadam roads sufficiently to prevent the formation of dust and the consequent destructive effect of excessive automobile traffic.

A bituminous macadam road does not differ from the original macadam construction until the process of binding begins. It has been found, however, that the former desirable qualities in road stones, such as hardness, toughness, and cementing qualities, do not play so important a rôle as formerly when the stone in question is to be treated with bituminous material. If we assume then the construction of a macadam road to have progressed through the stages of proper drainage, grading and consolidation of the subgrade, we then place the first course of No. 1 stone upon the rolled subgrade, as formerly. This no. 1 stone is still laid in the same standard sizes ranging from 2½ to 1¼ inches in diameter. After this course has been thoroughly rolled to consolidated thickness, say from 3 to 5 inches, the no. 2 course is than applied. There are two well defined methods for applying this course.

Mixing Method.—No. 2 stone varying in diameter from 1¼ to ½ inch is mixed with sufficient quantity of bituminous material to thoroughly coat all the pieces. This may be done by hand labor upon a mixing board, or by machinery. The practice of using mixing machines similar to concrete mixers is increasing and with the better types of machines results are satisfactory and the cost is reduced. Practice has shown that it requires in the

turbances by an upper bonding layer of bituminous material. It is a one-layer pavement and there is no definite distinction to be made between the wearing surface and the base, as in their nature they must be knit together in one structure. Practically all the horizontal stability, as well as vertical support, is from the macadam base. The pavement may be produced by adding the bituminous top to the macadam base by either the penetration method or the mixing method. In the former the bitumen is applied in a liquid state and a top dressing of stone or sand is spread over the surface and thoroughly rolled. In the latter the bitumen is mixed with the mineral, consisting of comparatively fine stone or sand, or a mixture of both, and forced into the macadam body of the pavement by rolling. In either case, whether the penetration or mixing method is followed, the macadam base must be specially prepared, with voids in the upper portion into which the bitumen or bituminous mixture penetrates leaving a coating of the desired thickness over the surface.

neighborhood of 1½ gallons of bituminous material per square yard of finished surface, so that if a second course were spread 3 inches thick loose, a cubic yard of stone would require about 18 gallons of bituminous material. After the coated stone has been put in place, a thin layer of clean, sharp fines (from which the best practice demands the removal of the dust) is spread lightly and the course is then rolled with a steam roller. Wherever an excess of bitumen appears on the surface, more fines should be added and rolled. After rolling is completed, all surplus fines and dust should be swept from the surface. A seal coat or paint coat or finishing coat of bituminous material to insure waterproofing and complete filling of the voids is now applied. This consists of a uniform application of about one-half gallon to the square yard of surface. Screenings or fines are again applied and the road may or may not be rolled.

Penetration Method.—By the penetration method, the second or no. 2 course of stone is put in place and partly rolled with a steam roller. The bituminous material is then applied either by hand from pouring pots or by some modified hose nozzle leading from a tank cart or by a mechanical distributor. Material for hand spreading is usually brought to the job in barrels; when a tank cart is used, it is generally filled from a tank car at the siding. Bituminous material is heated usually by steam from a steam roller, but when hand pots are used, the material is heated with kettles over fires. The application is about 1½ gallons to the square yard and the object is to penetrate the second course to a considerable depth. It is now considered good practice to apply the bituminous material under pressure from a hose fitted with a proper nozzle to spread the material in a finely subdivided stream, or spray. The object is to secure better penetration and more uniform distribution over the road stones. After the distribution of bituminous material, a light coating of sharp, clean fines or screenings or sometimes sand or clean gravel is applied and rolling progresses. A paint coat of about one-half gallon to the square yard is usually applied, followed by a coat of screenings to complete the construction.

The above description presents a bold outline of bituminous construction and it must be understood that various modifications in processes are practiced, e.g., the no. 1 course may be bound with screenings or no. 2 course may also be partly bound with screenings, even with the use of a sprinkler and subsequent drying of the road. Some engineers prefer to apply the stone without screening into separate sizes with the object of securing the reduction of the voids by the use of crusher run stone. Other engineers have seen fit to use no. 1 stone as the second course. It is clearly evident that the final standardization of bituminous construction has not yet been reached. In round figures, the cost of bituminous macadam runs about 25 to 40 cents per square yard in excess of ordinary "waterbound" macadam.

Some engineers contend that an ordinary plain macadam construction, followed by a thorough paint coat, is the most desirable form, but this is essentially surface treatment.

A system introduced in England by Arthur Gladwell, now known as the Gladwell system of bituminous road construction, requires the spreading of a mixture of sand and bituminous material or fines and bituminous material over the top of the no. 1 or first course of macadam followed by a no. 2 course of clean, dry stone and a second layer of mixed fines and bituminous material. The three layers are then rolled with a steam roller. The object of this form of construction is to secure a thorough filling of the second course of stone by the mixture of fines and bituminous material from both above and below.

Throughout this description the term "bituminous material" has been used as a generic term and should be read to include all forms of artificial binders which are in common use.

The details of the management of bituminous material are extremely important. It is known that a proper selection of the bituminous binder is vital to the success of construction. Standard specifications for bituminous material are not yet in complete agreement. There are certain chemical tests which it is known that good bituminous material should satisfy. It is quite possible that these chemical tests have not yet developed final form and that additional physical tests should be introduced to enable proper selection of material. For further details as to matter of pressure, temperature, viscosity, etc., the reader is referred to articles upon bituminous road materials.

UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF PUBLIC ROADS

Specification for the Construction of Bituminous Macadam by the Penetration Method

SEPTEMBER, 1914

SUBGRADE

The subgrade shall be considered as that portion of the road upon which the first course of broken stone is to be laid. The subgrade shall consist of good, sound earth brought to the proper elevation, alignment, and cross-section, and shall be rolled until firm and hard. The rolling shall be done with a roller of the macadam type weighing not less than ten (10) tons or more than fifteen (15) tons. Should earth be encountered which will not compact by rolling, so as to be firm and hard, it shall be removed and suitable material put in its place and that portion of the subgrade again rolled. When the rolling is completed, the surface of the subgrade shall conform to the cross-section shown on the plans and shall have the proper elevation and alignment and shall be so maintained until the first course of stone is in place. If tracks or ruts are formed in the subgrade, the contractor shall scarify, reshape and reroll it.

Preparation of subgrade shall be paid for at the price bid per square yard.

CRUSHED STONE

The crushed stone used in this work shall be newly broken, of uniform quality throughout and free from tailings, slaty and flat fragments, soft or disintegrated stone, dirt or other objectionable matter.

The following designations and sizes shall obtain:

Dust. That portion of the product of the crusher which will pass through a screen having one-quarter (¼) inch circular openings.

Chips. That portion of the product of the crusher which will be retained on a screen having one-quarter (¼) inch circular openings and will pass through a screen having one (1) inch circular openings.

Screenings. That portion of the product of the crusher which will pass through a screen having one (1) inch circular openings, including the dust of fracture.

No. 2 Stone. That portion of the product of the crusher which will be retained on a screen having one (1) inch circular openings and will pass through a screen having circular openings not less than two (2) inches nor greater than two and one-quarter (2¼) inches in diameter.

No. 1 Stone. That portion of the product of the crusher which will be retained on a screen having circular openings not less than two (2) inches nor greater than two and one-quarter (2¼) inches in diameter, and will pass through a screen having circular openings not less than three (3) inches nor greater than three and one-half (3½) inches in diameter.

A sample of the stone when subjected to the hardness, toughness and abrasion tests as described in U. S. Office of Public Roads Bulletin No. 44, shall satisfactorily meet the following limiting values:

Hardness, not less than ——————; toughness, not less than ——————; and per cent of wear, not more than ——————.

Bottom course. The bottom course shall consist of a single layer of No. 1 stone, of the thickness, when compacted, as shown on the plans, and shall be spread so that after being thoroughly compacted with a road roller, of the macadam type, its surface will be paralled to and uniformly below the finished road surface by an amount equal to the thickness of the wearing course. When the bottom course has been thoroughly rolled, the voids between the stone shall be filled with stone screenings or coarse sand. In no case, however, shall such an amount of screenings or sand be used as to fill the bottom course to within less than one-half inch of its surface.[1]

Second course. The second course shall consist of a layer of No. 2 stone evenly spread over the bottom course to a depth of three inches, loose measurement. This course shall be dry rolled until the fragments of stone are well keyed together and the surface conforms to the cross-section shown in the plans. In order to allow penetration of the hot bituminous binder applied in the manner hereinafter specified, the surface of this course shall be open and porous.

In the event that any course of stone shall have become rutted or loosened by travel before the application of the next succeeding course, the contractor shall restore said course of stone to its proper cross-section with such materials and in such manner as the engineer shall direct.

Bituminous binder. The bituminous binder shall conform to the specification for such material.[2] Sufficient and approved facilities for delivering and heating the binder shall be provided. It shall be maintained within a temperature range of 250° F. to 300° F. for tar products, and 300° F. to 350° F. for fluxed native and oil-asphalt products.

First application of bituminous binder. The hot bituminous binder shall be uniformly distributed over the second course at the rate of 1½ gallons to the square yard, by either pouring from approved pouring pots or applied under pressure from a tank wagon equipped with hose and nozzle of a type approved by the engineer. Immediately after this application, clean stone chips shall be spread over the surface in sufficient quantities to just completely fill the surface voids, after which the course shall be thoroughly rolled. When the rolling is completed, any surplus chips shall be swept from the surface. The bituminous binder shall be applied only during dry weather, and the stone of the second course must be dry and clean at the time of application.

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[1] Worn macadam which is to be resurfaced with bituminous macadam shall first be cleaned of all loose dirt and foreign matter, and then scarified to a depth of three (3) inches. The loosened material shall be harrowed and reshaped to the proper crown by the use of a road machine or rakes, and sufficient new No. 1 stone shall be added to yield, when compacted, a bottom course of the required thickness. At the sides shall be formed shoulders of well rolled macadam, gravel, or earth, not less than three (3) feet in width.

[2] Climatic conditions, volume and character of traffic, kind of stone used and availability, are important factors to be considered in the proper selection of bituminous materials. Since any of these factors may vary greatly in different sections of the country, it is inadvisable to include a general specification for the bituminous material. Proper specifications will be furnished upon request if information relative to the above mentioned factors is given.

Seal coat. A seal coat of hot bituminous material shall be uniformly distributed as above described, at the rate of one-half (½) to three-quarters (¾) of a gallon to the square yard. It shall be immediately covered with a layer of clean stone chips, in an amount sufficient to take up all excess bituminous material, and shall then be thoroughly rolled.

Weather. No bituminous material shall be applied at any time when the air temperature is below 60° F., or when the air temperature within the preceding twenty-four hours has been 35° F. or lower.

Specifications for Bituminous Macadam—Mixing Method

U. S. Office of Public Roads

SUBGRADE SAME AS FOR PENETRATION METHOD

Upon the concrete or macadam base constructed as hereinbefore specified shall be laid a wearing surface of bituminous macadam, as follows:

MATERIALS

Crushed stone. The crushed stone used in this work shall be newly broken, of uniform quality throughout and free from tailings, slaty and flat fragments, soft or disintegrated stone, dirt, or other objectionable matter.

The following designations and sizes shall obtain:

Three-quarter (¾) *inch stone.* That portion of the product of the crusher which will be retained on a screen having one-half (½) or five-eighths (⅝) inch circular openings, and will pass through a screen having one and one-eighth (1⅛) or one and one-quarter (1¼) inch circular openings.

Chips. That portion of the product of the crusher which will pass through a screen having one-half (½) or five-eighths (⅝) inch circular openings, and be free from any material which will pass through a one-eighth (⅛) inch screen.)

Bituminous binder. The bituminous binder shall conform to the specification for such material.[3] Sufficient and approved facilities for delivering and heating the binder shall be provided. It shall be maintained within a temperature range of 250° F. to 300° F. for tar products, and 300° F. to 350° F. for fluxed native and oil-asphalt products.

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[3] Climatic conditions, volume and character of traffic, kind of stone used and availability, are important factors to be considered in the proper selection of bituminous materials. Since any of these factors may vary greatly in different sections of the country, it is inadvisable to include a

CONSTRUCTION

Wearing surface. The wearing surface shall consist of a single layer of a mixture of the three-quarter (¾) inch stone and bituminous material, above described, uniformly spread over the base to a thickness of not less than three and one-half (3½) inches before rolling.

The mixture shall be in the proportions of one (1) cubic yard of stone and eighteen (18) to twenty-one (21) gallons of the bituminous material. The exact amount of the latter will be determined by the engineer within the above limits and the amount so determined shall be used by the contractor.

The stone shall be heated in such a manner that no part of it shall have a temperature higher than 250° F. or lower than 200° F. To the heated stone shall be added the hot bituminous material and the whole thoroughly mixed until the entire surface of each particle of stone is covered with the bituminous material.

The mixing shall be done in a mechanical mixer so designed, constructed and operated that it will dry and heat the stone to a temperature of 250° F., and will thoroughly mix this heated stone and the bituminous material without in any manner damaging the latter by overheating.

The mixture shall be transported from the mixer to its place on the road in wheelbarrows, carts or wagons and dumped upon dumping boards, from which it shall be shoveled into place. The temperature of the mixture at the time of spreading shall be such that it may be readily spread in a layer of uniform density and thickness. Lumps that can not be readily broken up by the spreader shall be rejected. The operation of transporting, shoveling and spreading shall be so conducted that it shall not cause any segregation of any part of the mixture. When the mixture has been properly spread, it shall be thoroughly compacted by rolling with a roller weighing not less than ten (10) tons or more than fifteen (15) tons and heavy ramming at places inaccessible to the roller. All of the mixture shall be rolled or tamped during the same day that it is laid.

Seal coat. To the well-rolled surface shall be applied a seal coat of bituminous material at the rate of from one-half (½) to three-quarters (¾) of a gallon to the square yard. The application may be made from a hose connected to the supply tank or by approved pouring pots, and shall be evenly broomed over the surface if necessary to obtain a uniform distribution. The coated surface shall be immediately covered with a layer of chips of sufficient thickness to take up all excess of bitumen. The surface shall then be finished by thorough rolling.

general specification for the bituminous material. Proper specifications will be furnished upon request if information relative to the above mentioned factors is given.

Brick Roads

Vitrified paving brick have been in use in this country a little more than thirty-five years as a wearing surface for streets and highways. In their early history little attention was given to using them in the most advantageous way, either as to durability or as to the possible satisfaction in their use. It was rather a commingling of varied ideas with a good material, with no definite realization of what is really possible in a brick street constructed under the most approved methods of today.

Vitrified paving brick are manufactured from fire clays and shales which are found in various regions throughout the United States. No two deposits of these shales or clays are exactly alike; they do not burn alike either in color or in the amount of heat required to bring them into the best condition adaptable for their use, so that the raw material must receive slightly different treatment at each of the factories. On this account brick of different manufacture differ in appearance.

A brick burned sufficiently to develop the best quality from any one of the clays and shales used is almost impervious; at least sufficiently so that the amount of moisture absorbed, regardless of temperature, does not affect the brick in any way.

In the use of vitrified brick for a wearing surface, due consideration must be given to the amount and character of the traffic in determining the width of the road and the character of construction. The amount of money possible to expend must also have due weight. The available local materials which may be used in the construction of the road in addition to the brick, must also be taken carefully into consideration. For example, it is necessary to determine whether concrete shall be used as foundation, and, if so, of what the concrete shall consist, or whether there shall be any artificial foundation at all. The question of whether the road is to to be located in the northern portion of the country subject to extreme climatic conditions or in the extreme south where low temperature need not be guarded against is of great importance. The question of drainage also enters materially into the problem.

The type of the road therefore must be influenced by some one or more or even all of the foregoing, as every feature to a greater or less extent bears a particular relation to the economy of the road itself. To illustrate: the black mucky soil of somewhat difficult drainage of northern Illinois where practically all of the thoroughfares are subject to a traffic of numerous and heavily loaded vehicles, and subject also to extremes of low temperature and liable to consequent damage from frost, require the best and more expensive type of roads. In and about the Gulf Coast where the soil for the most part carries a large proportion of sand and is not subject to frost action economical roads can be built without any artificial foundation at all by merely preparing the grade to correspond with that of the finished highway. The requirements for these two types of roads as to local conditions to a very large degree equalizes the cost in respective localities. For instance, in northern Illinois the brick on account of freight rates are slightly less in cost and the material, such as gravel and broken stone, which enter into the foundation are of low cost so that a road built in northern Illinois corresponds in price to the road equally adapted to conditions found in the South and this state of affairs very largely obtains throughout the country, so that the cost of adaptable types is not materially different.

As to the different types and kinds they may be approximated as follows: the best and most expensive type that shall meet severest conditions as well as severest traffic must be made with a carefully drained and thoroughly compacted subgrade, the surface of which shall be made to exactly conform with that of the finished highway. Upon this subgrade must be placed a concrete base finished with a smooth surface and from 4 to 6 inches in depth. On this base a compressed sand cushion to a uniform depth of two inches is placed. Upon this 2-inch sand cushion must be placed the brick with the best edge up. These bricks after being so placed must be rolled and ironed out so that the plane presented by the surface shall be entirely free from any depressions. Following this condition the interstices shall be completely filled with a mixture in uniform preparation of 1 to 1 of sand and portland cement. Provisions shall also be made along either curb for contraction and expansion. The details for installation of this work may be obtained from the National Paving Brick Manufacturers Association by a request for the same addressed to their headquarters in Cleveland, Ohio. The cheapest and least expensive type eliminates from the foregoing the foundation of concrete and even cement filler so that a road in the sandy districts can be made based upon the expenses of the brick, the curb and the preparation of the grade. Intermediate conditions necessarily obtain here and there throughout the country where with good judgment economy may be greatly subserved in the manner and method of building with due consideration of the traffic to which the roads respectively are to be subjected. Let it be thoroughly understood that the highest and best type is not only satisfactory and sanitary but of the greatest durability. However, the cheaper type is ofttimes advisable because of lower first cost and traffic requirements. The maintenance cost of a well constructed brick road is small and its advocates claim that this cost is negligible.

Specifications

Standard specifications for vitrified brick highways may be obtained upon application to the National Paving Brick Manufacturers Association, Engineers' Building, Cleveland, Ohio.

Concrete Roads

Types.—The methods of construction of concrete roads divide them into one course, two course and one and two course reinforced.

Materials.—1. Portland Cement. The cement shall meet the requirements of the United States government for Portland cement or of the standard specifications for Portland cement of the American Society for Testing Materials.

2. Fine Aggregate. Fine aggregate shall consist of sand, crushed stone or gravel screenings, graded from fine to coarse, and passing when dry a screen of ¼–inch mesh. It shall be preferably of silicious material, clean, free from soft particles and dust (both loose and occurring as a coating on the grains), loam, vegetable or other deleterious material; and not more than 20 per cent shall pass a sieve having 50 meshes per lineal inch, and not more than 5 per cent shall pass a sieve having 100 meshes per lineal inch. Fine aggregate shall be of such quality that mortar composed of one part Portland cement and three parts fine aggregate, by weight, when made into briquettes, will show a tensile strength at least equal to the strength of 1:3 mortar of the same consistency, made with the same cement and Standard Ottawa Sand. In no case shall fine aggregate containing frost or lumps of frozen material be used.

3. Coarse Aggregate. Coarse aggregate shall consist of stone or gravel, graded in size, retained on a screen of ¼-inch mesh, and passing a screen of 1½ inches mesh. It shall be clean, hard, durable and free from all deleterious matter and shall contain no soft flat, or elongated particles. In no case shall coarse aggregate containing frost or lumps of frozen material be used.

4. Natural Mixed Aggregates. Natural mixed aggregates shall not be used as they come from deposits, but shall be screened and remixed to agree with the proportions specified.

5. Water. Water shall be clean, free from oil, acid, alkali, or vegetable matter.

Equipment.—In addition to the usual equipment needed in the preparation of the subgrade or foundation for all types or roadways, there will be required for the construction of a concrete roadway a good concrete mixer of the batch type provided with traction power, a sufficient amount of 2–inch lumber capped with angle irons or steel side arms for side forms, wheel-barrows, shovels, the finishing and other small tools owned by every contractor doing concrete work and some means for hauling materials.

On large work, or long hauls or in districts where men and teams are scarce, hauling on industrial railways, and with traction engines, and motor trucks has been found to be economical, and the comparatively large amount of water required can probably be best attained from the nearest source of supply by pumping through small metal pipe lines with small gasoline engines, rather than by hauling in tank wagons with teams.

Foundation.—The subgrade or foundation upon which concrete is to be laid should be made flat and brought to a firm unyielding surface by rolling, and all soft, spongy or yielding spots and all vegetable or perishable matter should be entirely removed from the subgrade and the space refilled with gravel, broken stone or other suitable material. Special attention should be paid to drainage and water must be kept from reaching the foundation by means of open ditches or tile or French drains, provided with suitable outlets. Old macadam or gravel roadways make ideal foundation upon which to lay concrete, provided the same are scarified and made flat and the surface sealed with clay or loam or other material thoroughly wet and rolled, which will prevent the grout from the concrete running into the sub-base and will prevent any bond between the sub-base and the pavement. The surface of the sub-base must be smooth and free from all irregularities.

One-Course Roadway.—Upon the properly prepared subgrade concrete should be deposited having a thickness of at least 5 inches at the sides and 7 inches at the crown. It should be made in the proportion of at least one bag of Portland cement, 1½ cubic feet of fine aggregate and 3 cubic feet of coarse aggregate. The mixture should be of such consistency as to settle to a flattened mass and yet cause no segregation of the aggregate and the surface struck off with a template cut to the proper shape of the road and running on the side forms. The rough places left after the use of the template, should be smoothed with a wooden float.

Two-Course Roadway.—Upon a properly prepared subgrade should be laid concrete mixed in the proportion of at least 1 sack of cement to not more than 2½ cubic feet of fine aggregate and not more than 4 cubic feet of coarse aggregate, having a thickness of at least 4 inches at the sides of the road and 6 inches at the crown. The concrete should be mixed as wet as is practicable, and should be placed as soon after mixing as possible but in no case should more than thirty minutes elapse between the mixing and the placing of the concrete base. The concrete base should be deposited in strips extending across the full width of the area paved and should be brought to a surface the thickness of the wearing surface below the finished surface of the roadway.

The concrete base before it begins to harden should be covered with a wearing course at least 2 inches thick composed of one sack of cement, and 1 cubic foot of suitable fine aggregate to 1½ feet of coarse aggregate, ranging in size from ¼ inch to ¾ inch.

The wearing course should be placed as soon as it is mixed and in no case should more than forty-five minutes elapse between the mixing of the concrete base and the finishing of the wearing course.

After the wearing course has been struck off with a template the rough places should be smoothed with a wooden float.

Protection.—The concrete shall be sprinkled with water as soon after finished as may be possible without pitting the surface. It shall be kept moist in this manner for at least 10 days during which time it shall be protected from the elements by covering with canvas, sand or earth. No travel shall be allowed upon it until the concrete is 14 days old.

Joints.—To provide for free movement of the concrete, the road should be laid with joints of ½-inch width not more than 30 feet apart. Such joints should be vertical and extend entirely through the concrete. They should be filled with tar paper or tar felt, or a a waterproof filler.

Crown.—The road should be given a crown at the center of at least one-hundredth and not more than one-seventy-fifth the width of the road.

Reinforced Concrete Pavement.—When the road is 20 or more feet wide, reinforcing shall be used; the same shall consist of wire fabric or of plain or deformed steel bars. The cross-sectional area of the transverse reinforcing shall amount to at least 0.041 square inch per lineal foot of length of roadway measured parallel to the axis of the street. The cross-sectional area of the reinforcing metal running parallel to the center line of the pavement shall amount to at least 0.04 square inch per foot of pavement width and the cross sectional area of the reinforcing metal which is perpendicular to the center line of the pavement shall amount to at least 0.05 square inch per foot of pavement length. The reinforcing shall be placed 2 inches from the upper surface of the pavement, and shall be lapped, where necessary, sufficiently to develop the full strength of the metal. The reinforcement shall extend to within 2 inches of all joints in pavement and under no condition shall be continuous across them.

Specifications for Cement

Bulletin No. 33, issued by the Bureau of Standards of the U. S. Department of Commerce, contains complete Specifications for Portland Cement approved by Inter-Departmental Committee, and may be obtained upon application to the director of that Bureau, Washington, D. C.

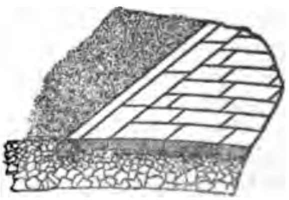
Asphalt Blocks on Country Roads

As designed and manufactured for use on country roads, the asphalt blocks are 5 inches wide, 12 inches long, and 2 inches deep, weigh about eleven pounds each, and have a specific gravity of about 2.40.

The asphalt block was developed and perfected on the theory that crushed trap rock, on account of its preëminent hardness and inherent grittiness, made the best known material for a roadway surface, the one thing needed being a cement, or binding material, to keep all of the particles permanently in place. This was accomplished by the use of an asphaltic cement to bind together the properly graded particles of crushed trap, the hot mixture being consolidated by tremendous pressure into blocks so dense and free from voids as to be practically non-absorbent. In the asphalt block, therefore, we have an asphaltic concrete, or macadam, mixed, in exact proportions, at a great central plant, under conditions insuring absolute uniformity, and receiving the compression necessary to produce a dense and non-absorbent material.

Not only has a special block been produced, but a special method of construction has been worked out, designed to utilize what is left of the worn and rutted macadam road as a foundation for the blocks. This is accomplished by scarifying the surface, if necessary, filling up the deep ruts, rolling with a heavy steam roller, and laying upon the surface of the old macadam, a bed of cement mortar about 1 inch in thickness, to serve the double purpose of forming a firm unyielding bed for the blocks, and binding them securely to the macadam foundation underneath. By this method the material used in the original construction of the road is not thrown away, but used as foundation for a permanent wearing surface. Where the old macadam is too thin, or too badly worn to be safely used as a foundation, it will be necessary to lay a concrete base, but usually there is broken stone enough in the old macadam to supply what is needed for laying concrete.

A pavement may be laid of any desired width. contour, grade, or crown. It is perfectly feasible to pave one-half of the roadway, or only a narrow strip in the center, and extend the paved area at a later date as traffic necessities require, or as appropriations become available. It is not necessary to set curbstones or heading stones to border or define the paved area, since a row of stretcher blocks held firmly in place by a shoulder of mortar, as shown in the sketch, answers the purpose perfectly and leaves the entire roadway surface smooth and uniform.



A good example of this construction is on the Albany Post Road, through the villages of Hastings-on-Hudson, North Tarrytown and the Town of Mount Pleasant, N. Y., and on the Boston Post Road in Pelham Manor and Rye, N. Y.

ROAD MAINTENANCE AND REPAIR

These terms are quite generally confused and are often used without distinction. The essential difference in practical road work is one of size or quantity. Large repairs may be reduced by more frequent attention to small repairs; these in turn by still closer attention become very small repairs and finally by a system of practically constant attention develop into maintenance. A well maintained road surface, therefore, will generally require no repairs until reconstruction or replacement is necessary. Sometimes work on culverts, bridges and the renewal of shoulders after heavy rains are considered repair.

The repair of gravel and earth roads is well explained in the article on the construction of the same.

To distinguish the repair of macadam roads from their maintenance, the word repair may be restricted to those operations commonly called resurfacing. When an old macadam is worn so thin or becomes so full of chuck holes that small scattered repairs are insufficient to maintain it, it is usually resurfaced; the period between resurfacing operations on a large number of roads as reported by the United States Office of Public Roads is about 6.5 years. It is becoming increasingly common to resurface macadam roads with some form of bituminous construction. If the old macadam surface is first scarified or picked up with the roller or by hand labor, and considerable new stone added, the repair operations go forward from this point as in bituminous macadam construction. When no bituminous material is used in macadam road repairs, the scarified surface is brought to true crown and graded by the addition of new stone and thoroughly rolled and bonded as in ordinary macadam road construction. There is considerable variation in the method and amount of scarifying or loosening of the old macadam surface; e.g., if a macadam road has simply developed a horse track or worn travelled way for a width of 6 to 8 feet in the center, the road is sometimes repaired by thoroughly sweeping and adding sufficient new stone to restore the crown without scarifying. Sometimes the edges only of a macadam roadway are scarified or picked to insure a bond of new stone with the old road course. Scarifying or picking up of the old road surface may be entirely omitted and new stone put in place without disturbing the road crust. This should never be done without first thoroughly scouring the old surface with stiff brooms and flushing with hose, if possible, otherwise a dust layer will be present and no bond develops between the new and old material. Of course, if a hose cannot be had, thorough dousing with a sprinkling cart will suffice.

Many macadam roads are now repaired by what is known as surface treatment. A typical example of this process is as follows: The old road is thoroughly cleaned of all dust and refuse; and an application of bituminous material is made on the road of from 0.15 to 0.5 gallons to the square yard followed by a uniform coating of screened trap rock, gravel or coarse sand. The material should not exceed ¼ inch in greatest diameter. If ruts or holes are present, they should be brought up to a true surface with additional bitumen and coarse screenings. The road is now rolled; another application of 0.25 gallon to the square yard of bituminous material is made and the second course of screenings applied. Such depressions as developed are of course filled with screenings as the work proceeds and a sufficient excess of bituminous material should be given to such spots. A supply of surface screenings should be left along the road when such repair methods are used so that they may be spread subsequently to take up any excess of bituminous material that develops on the surface.

Maintenance

Undoubtedly the best system of maintenance for all roads is that which provides for the permanent and sometimes continuous employment of skilled laborers who have charge of particular sections of road, or who may be assigned to any part of the county or other road unit where there is work most needed. Men employed in this way become experts in their particular line and if they make mistakes one year or in one place, they are apt to correct them, whereas under the labor tax system, mistakes are often repeated. If one man is employed to look after a particular stretch of road, he will learn to take pride and interest in his work.

The continuous maintenance system has been adopted in this country only to a limited extent. It has been used by the Massachusetts highway commission for several years. The New York State highway commission introduced it in the year 1910 for the maintenance of State roads, and Allegheny County, Pennsylvania, employs it for the maintenance of about 100 miles of county roads. The office of Public Roads has also determined its effectiveness on experimental stretches.

While it would be manifestly impossible to adopt the continuous maintenance system throughout the country on account of limited resources, and sparse population, still there are many places where it might be used with success. It would be difficult to find a county which is so poor that it could not afford to employ continuously eight or ten laborers and three or four teams to maintain and repair its principal roads. That such a plan would be more effective than the labor tax system has been often proved.

Of all our roads, the earth roads are probably the most neglected. The first and last principle in the maintenance of earth roads is to keep the road well drained. Water is the great enemy to our clay or soil roads, and must be removed immediately, or mud results. To insure good drainage, the ditches must be free and the smooth crown of the road maintained. For this purpose the split-log drag, or an equivalent drag is very useful and, at the same time, inexpensive. The drag can be used on a sand-clay road or gravel road with good effect.

The following points govern dragging on earth, gravel or sand-clay roads: The drag should be light, and should be hauled over the road at an angle of about 45 degrees so that only a small amount of earth is pushed to the center of the road. The driver may ride on the drag and should not drive faster than a walk. Some men like to weight the drag and direct it by handles arranged like plow handles. Dragging should begin on the side of the road, and the return made on the opposite side. Unless a road is already in good condition, it should be dragged after every heavy rain, when the mud will puddle well, and still not adhere to the drag. A few trips over the road will give the operator a clue as to the proper and best time to drag. If a road is dragged immediately before a cold spell, it will freeze smooth.

Always drag a little earth toward the center to keep the slope of the crown about an inch to the foot. If the drag cuts too much, shorten the hitch or change the weight on the drag. The results from dragging are obtained only by repeated operations. A good system of dragging is that which is practiced in Kansas and Iowa, where road authorities are authorized to let contracts to farmers for dragging the roads abutting their lands. The cost of dragging will be for from $0.75 to $1.25 per mile per complete dragging of several trips. The cost will depend on the width and price of teams. From 15 to 30 draggings should be given a road the first year.

It is impossible sometimes to hold a road of soft material together during protracted rains and especially in winter when freezing occurs at intervals; but conditions will be greatly improved by the construction of underdrains in cuts along side hill sections or where groundwater shows a tendency to appear on the surface. The expense of subdrainage, if properly installed, will invariably find return in the improved state of the road during wet weather.

With reference to the maintenance of macadam roads, it is pertinent to state at the outset that it is doubtful practice now to patch macadam roads without using some form of artificial binder. A few automobiles a day passing a well made patch will frequently destroy it. There are, however, roads where a strictly macadam surface must be maintained. In repairing such roads, the stones should be applied only after the depressions have been thoroughly cleaned with stiff brooms and it is desirable to pick the edges with hand picks. The stones should be thoroughly wet, rammed and bound with fines. An essential feature of all stone road repair is to have a supply of stone and binding material at frequent intervals, not less than 100 tons to the mile. Do not attempt to patch a road with stone greater than 1½ inches in longest dimensions and use clean screenings. Road sweepings or organic matter and rubbish must never be used to bond stone patches. The maintenance of all kinds of macadam roads will be more effective if such roads are rolled in the spring with a steam roller when the frost has left the ground.

Where a patrolman has charge of waterbound macadam roads, he should take advantage of all wet weather to discover depressions in the road and to improve drainage. A patrolman should also remove all loose stones as they are particularly injurious to automobile tires and to the road used by automobiles. Such stones should be collected in piles of sufficient size so that no stone is wasted. An important item of maintenance of macadam roads is the paring of the shoulders and attention to weeds and sod which encroach on the roadway. If a road has been lined and graded it should be possible to cut weeds and grass on the shoulders with a mowing machine.

The importance of all forms of maintenance on roads is becoming more clearly recognised. It is an administrative problem. Where good business management is introduced, success follows. It is quite possible that extensive modern roads can be absolutely maintained for an indefinite period if they are given the proper surface treatment at necessary intervals. Frequently, however, even the best constructed road depreciates and ultimately requires rebuilding, because of the failure to properly systematize the maintenance.

DUST PREVENTIVES

Until comparatively recent years, the macadam road, if properly constructed of suitable material, was theoretically correct and practically sufficient to withstand the average traffic of our rural communities. It was dependent for its bond upon the dust produced by traffic, and so long as this dust remained upon the road surface to be washed into the interstices by occasional rains, a macadam road gave excellent and satisfactory service. With the advent of modern fast motor traffic, however, these roads began to deteriorate rapidly, since the rubber tire created practically no dust, but raised such as there was and allowed it to be carried away from the surface. This displacement not only robbed the road of valuable binding material, but created a menace to the health and comfort of the community. The need for a remedy soon became of paramount importance, and we have at present a great variety of materials for the purpose of laying the dust and thus tending to preserve the surface.

Water has been, of course, the best known and most generally employed dust preventive. It effects a mechanical bond between the particles of dust and rock, and with certain types of rock it has been shown to develop a chemical bond by hydrolyzing some of the rock components with the formation of colloidal cementing materials. The effect, however, is only temporary, and under heavy motor traffic, in dry weather, continual sprinkling is necessary which soon becomes an expensive item. Sea water has been tried with better success, owing to the fact that certain magnesium and calcium salts contained in it are capable of retaining moisture for a considerable length of time. The large amount of common salt also contained forms an objection to sea water, since in wet weather it leads to the formation of a salty mud which is injurious to the paint and iron work of vehicles. The good results of sea water without its disadvantages are obtained by the use of calcium chloride which is obtained as a comparatively cheap by-product in the manufacture of soda by the ammonia or Solvay process. This material was formerly applied in solution, but recently it has been prepared in a fine granular form to be spread over the road surface in a thin layer. It takes up water immediately, giving the surface a damp appearance, and proves quite efficient where the average moisture in the atmosphere is sufficient to feed the salt. Otherwise, an occasional light sprinkling with water is necessary. The salt is, of course, washed away by repeated rains and must be replenished from time to time, so that the cost of the treatment is largely dependent upon local climatic conditions.

The purpose of the above-mentioned materials has been essentially to retain water as a binding agent in the road surface. Another by-product which of itself contains some excellent binding qualities is commercially known as "Glutrin." It is a concentrated waste sulphite liquor obtained by the evaporation and treatment of liquors obtained in the manufacture of paper from wood pulp by the sulphite process. When diluted with water and applied to the surface of a macadam road, it effectively reduces the formation of dust, and produces a firm, hard surface. The binding material, however, is soluble in water, and the treatment must be repeated during a season.

The waste molasses or "black strap" from sugar refineries in conjunction with milk of lime has also been used in surface treatment, and this gives some promise of becoming an economic and satisfactory material in localities where it can be obtained cheaply. It depends for its binding value upon the formation of calcium sucrates by the action of lime on the sugar contained in the molasses. These are tough, sticky substances, sparingly soluble in water and possessing considerable binding value. The use of this material is at present, however, an experimental proposition.

The greatest development in the preparation of dust preventives has been made in the utilization of bituminous products such as petroleums, coal tars and water-gas tars. These materials were first used in their crude state, but the results were only partially satisfactory, so that now we have to deal almost entirely with refined products. Practically the only exceptions to this statement are the recently exploited Trinidad oils, which consist naturally of a light volatile fluid carrying a large amount of true asphaltic base, and some of the more fluid crude California petroleums which are all of an asphaltic nature. Artificial products in many ways resembling the Trinidad oils have been produced by fluxing and cutting back some of the oil asphalts with volatile distillates. Some nonasphaltic petroleum preparations are used with satisfactory results as dust preventives and in proportion to their viscous or adhesive quality, make the fine particles of dust adhere to each other, thereby holding the powdered top dressing in a moist cushion in the center of the road, consequently helping to preserve macadam roadbeds against pitting or raveling.

In order to facilitate the application of petroleum products, more particularly to park roads and suburban streets, emulsions have been prepared with some cheap soap as the emulsifying agent. When such an emulsion is properly compounded, the oil becomes readily miscible with water and can be successfully applied from an ordinary sprinkling cart. Many of the large producers now have on the market so-called emulsified oils which contain a proper amount of soap to permit of their being mixed with water quite readily.

Increasing quantities of tars which are obtained as by-products from our gas and coke industries, are being used for the manufacture of dust preventives and road binders. Low carbon coke oven tars and water-gas tars or mixtures of the two when properly refined are the most desirable of this type of product for cold surface applications; and a considerable amount of work is being done with light tars carrying a small percentage of an oil asphalt in solution.

The cold application of any of the types of petroleum or tar products may be made when the material is sufficiently fluid, but the more viscous products must be heated. In either case, best results are obtained by first cleaning and repairing the road surface, after which an application of sufficient material to uniformly cover the surface should be made. The quite common mistake of flooding the surface and permitting large quantities of material to go to waste in the ditches should be guarded against. When possible, traffic should be kept off the road for ten or twelve hours to allow the application to penetrate thoroughly, after which a light coat of sand or stone screenings may be spread over it. A treatment of this character not only keepsdown the dust for some time but, when a proper grade of material is used, forms a protecting mat which prevents excessive wear on the road surface.

A clean, practically dustless surface is the prime requisite for any form of successful surface treatment, and neglect to have such a properly prepared surface is too frequently responsible for unsatisfactory results. The surface should be reasonably clean for the application of a simple dust layer, since it is not the purpose of such an agent to lay any quantity of dust which may be present on the road, but rather to hold the products of wear for a period after the application has been made.

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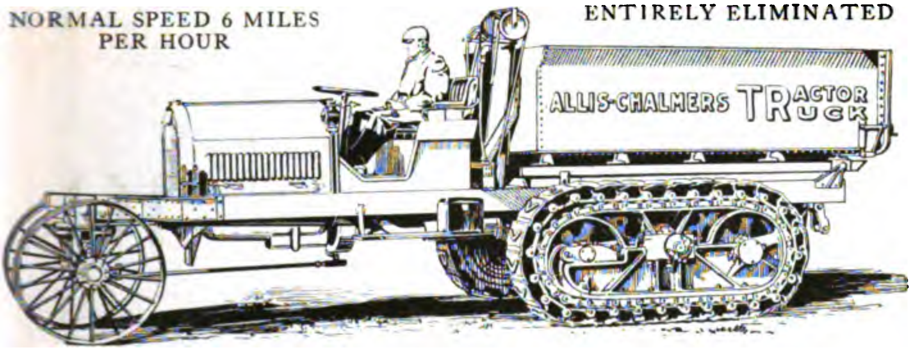

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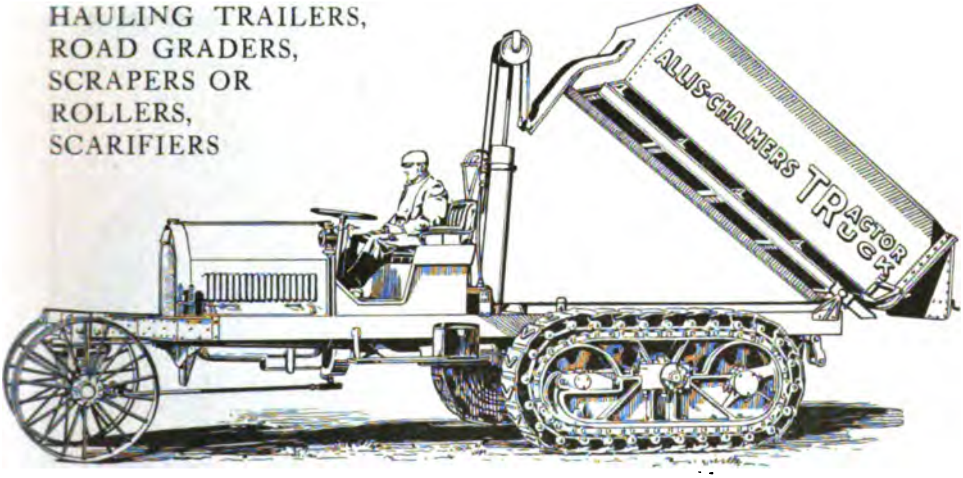

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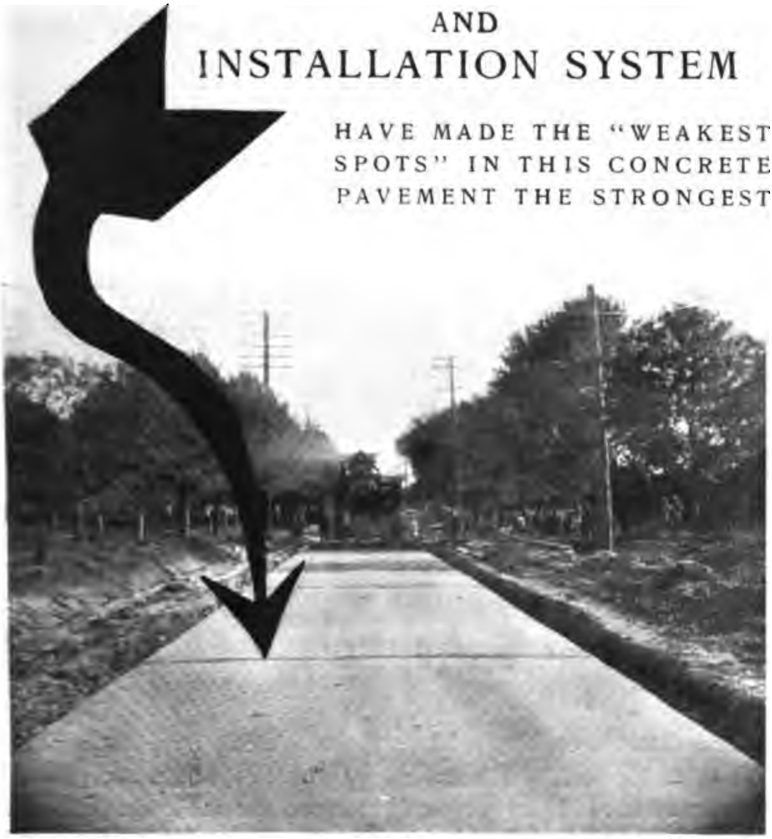

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Engineers and officials with reputations to preserve, and taxpayers whose money is to be spent may well consider also that even if there was any material for paving and road-building equaling the lake asphalts in stability, dependability and long life, **it would take 30 years to prove it.**

THE BARBER ASPHALT PAVING COMPANY

PHILADELPHIA - PENNSYLVANIA

In Suburban Development—

Modern suburban real estate developments require a pavement which will attract property owners. It must be easy to build at a reasonable cost; it must be capable of standing the stress of new building operations; it must show a low maintenance cost during the development of the property; it must be easy of repair after openings have been made for water, gas and sewer connections; and it must be satisfactory to the property owners through a long series of years after the property has been sold.

Tarvia pavements meet these specifications.

"Tarvia X" is used as a binder in the construction of macadam roads.

"Tarvia A" and "Tarvia B" are used for maintenance on many kinds of roads.

Send for booklets and information to the nearest Barrett office.

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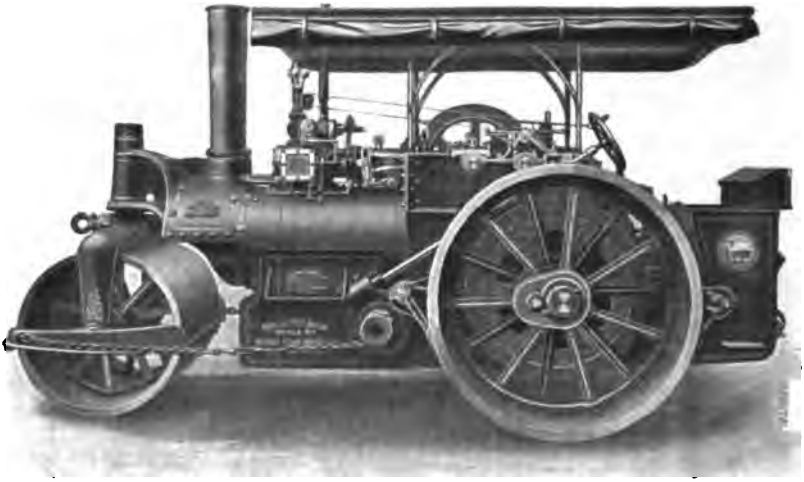

Buffalo Pitts Rollers are the result of long experience in Road Roller Building

Their record for efficiency and durability is unequaled

Made in all types and all sizes for all purposes 2½ to 20 tons

Buffalo Steam Roller Company Buffalo, N. Y.

Tower Avenue Road, Superior, Wis. Length 10,560 feet—Width 9 feet. One course 8 inches thick at crown, 6 inches at sides. CHICAGO-AA used.

Good for a Life-Time Without Repairs

A concrete road, when properly constructed, leaves nothing to be desired. Durability, low first cost, and future upkeep should be considered in the construction of a road. Concrete is low in first cost, low in upkeep and is good for a life-time without repairs.

One of the greatest assurances of durability in a concrete road is the use of CHICAGO-AA Portland Cement — the brand which has made good in service —seventeen years on the market with never a justifiable complaint.

CHICAGO PORTLAND CEMENT COMPANY

30 North La Salle Street :: Chicago, Illinois

NATIONAL PAVEMENT

IS COMPOSED OF

EARTH AND ASPHALT

NATIONAL PAVEMENT LAID ON EARTH BASE

Earth of any kind is utilized by reducing it to a hot, dry, fine dust and mixing it in given quantities with a bituminous binder. The binder is completely absorbed.

National Product is accepted by the leading Engineers, Road Builders and Contractors.

"National Pavement" is absolutely uniform throughout; its component parts unite as one and cannot be separated.

The product is of the highest quality and ***Indestructible*** in character.

"National" is as ***Waterproof*** as rubber, as ***Dense*** as lead and as ***Noiseless*** as earth.

Its malleable quality is unchanged by the heat in summer, or the cold in winter.

Different from all other pavements, because its surface will not fracture, hence a smooth surface, free from ruts and holes.

Write for descriptive booklet

BITUMINIZED ROAD COMPANY
KANSAS CITY MISSOURI

Where Durability Counts

UNDERNEATH the ground, where there are numberless destructive elements constantly at work, and where it is of the utmost importance to preserve the integrity of the road-bed—there

shows its superiority even more than in any other situation.

It has been in continuous service under ground under pressure for more than 250 years.

Why Experiment?

The following makers of Cast Iron Pipe are independent of each other and competitors; inquiries may be sent to any or all of these with assurance of prompt and full response.

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Concrete Bridge, Wendell, Mass.

Highway Engineers Use Corrugated Bars

because they have double the bonding value and twice the elastic limit of plain or twisted bars. A concrete bridge, reinforced with Corrugated Bars, will stand greater emergency overloads than if constructed with any other type of reinforcement. The lugs grip and hold, preventing slipping or splitting of concrete.

Corr-Slab Bridges

We have standardized the design and reinforcement for flat slab bridges so that no detailing is required.

The engineer sends us the overall length and width of the bridge and we send him a lump-sum bid on the reinforcement, made up in Corr-Bar units ready to place.

These units are the most efficient type of reinforcement that can be used in concrete work.

By this means highway engineers all over the country have used our specialized engineering skill and experience extending over 24 years, and are able to secure the important item of "Good Bridges" in "Good Roads" with the least possible effort.

Send for designing diagram on Corr-Slab Bridges

Corrugated Bar Co., 421 MUTUAL LIFE BUILDING, Buffalo, N. Y.
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Concrete Roads pay for themselves in the actual increase in the value of farming land; they pay for themselves in the saving of wear and tear on vehicles; they pay for themselves in time saved by hauling larger loads; they pay for themselves by enabling the farmer to get his products to market when prices are high; and their ultimate cost is cheaper.

CRESCENT PORTLAND CEMENT CO.

WAMPUM PENNSYLVANIA

UNITED STATES GOVERNMENT MODEL ROADWAY—Chevy Chase, Md.

THE section of the government model roadway shown in the photograph is paved with WIRE-CUT-LUG BLOCKS. It represents perfect monolithic construction, as the joints between the brick are completely filled with cement grout. The square edges of the WIRE-CUT-LUG BLOCK afford a surface that is even and smooth but not slippery.

Leading paving brick manufacturers reaching every section of the country are now making this perfect type of paving block.

Our engineering corps will personally show you how to duplicate this excellent construction. Their services are freely given wherever called for.

Dunn Wire-Cut-Lug Brick Co.

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CONCRETE FOR PERMANENCE

Concrete roads and pavements have come to stay. Experts on road construction advocate concrete unqualifiedly as the best type of road for every purpose. The experience of the West has made them enthusiastic, and the East is rapidly falling in line; contractors who were unfamiliar with this class of work are waking up, for from all points of the compass comes nothing but praise.

The successful construction of a road depends upon the materials used, and those who do the work. The contractor who has a concrete road to build can dismiss all concern from his mind regarding the cement he will require by ordering our good "old reliable" "GIANT," as we guarantee it to be the equal of any brand of American Portland Cement, and can point to concrete roads built with our product that are entirely satisfactory in every respect to the contractor, the engineer—and most important of all—to those whose money made possible their construction. When you need an A-1 cement, give us a chance to get acquainted.

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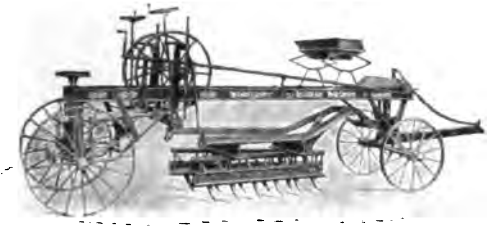

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Galion Basic Pure Iron and Galion Sterling Metal Culverts possess every desirable culvert feature—**Quality, Purity, Strength, Durability, Efficiency and Economy.**

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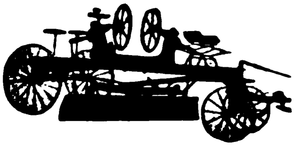
GOOD ROADS MACHINERY



Improved Steel Champion Road Machine, Strong, durable, convenient, capable.

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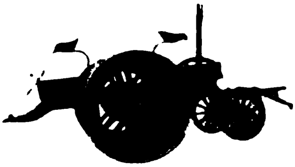

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The Best for

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ASPHALT BLOCKS

FOR

RESURFACING COUNTRY ROADS

A REAL PAVEMENT ON A REAL COUNTRY ROAD

THE ALBANY POST ROAD

The construction in 1910 of an asphalt block pavement on this main artery of travel out of New York City has resulted in the adoption of asphalt blocks for about 30 miles of roadway in Westchester County, and the very general adoption of this style of construction in many other localities in New York and neighboring states.

(Read article on Asphalt Block, page 144)

The Post Road was reconstructed and paved

by

THE HASTINGS PAVEMENT CO.

New York City

Manufacturers Contractors

Caterpillar Tractor Grading Roads For Wharton County, Texas

Proof of CATERPILLAR Success

Reg.U.S.Pat.Off.

Don't Say Caterpillar Unless You Mean the Tractor Holt Builds

The Caterpillar will haul your material, pull road graders, crush rock or run a mixer, in good weather or bad. It's the one all-season tractor—soft or slippery surface conditions won't cause expensive tie-ups. The Caterpillar track makes the difference—no wheels to slip or mire.

Skagit County, Wash., has reduced its hauling cost from $1.50 to 45 cents per yard with the Caterpillar.

The California State Department of Engineering has purchased four Caterpillars, one right after the other.

Wharton County, Texas, has ordered its second Caterpillar, after a year's success with the first.

Yellowstone County, Montana, has made the best roads in the state at the cheapest cost—they give a big share of the credit to the Caterpillar. They have bought their second Caterpillar. Seven leading Counties in Montana are also Caterpillar owners.

Private contractors, too, find the Caterpillar best. The J. F. Cogan Co., of New York, used three Caterpillars to clear land for the great Catskill Aqueduct. The Water Users' Association, of Casa Grande Valley, Arizona, is using two Caterpillars to build canals. The Colony Holding Corporation, of Atascadero, Calif., has a whole battery of Caterpillars clearing land and hauling.

Our thirty years' manufacturing experience—ten years with the Caterpillar—have made this tractor a proved success. We can prove to you by facts and figures, how it will save you money, how it will outwear and outwork horses or round wheel tractors. Ask for Bulletin No. 243.

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Repair and Maintenance of Roads

Pembroke Road, Bryn Mawr. Pa.

It is a great benefit to a community to have GOOD ROADS built—but it is a greater benefit to have them kept in GOOD REPAIR. To do this satisfactorily, the materials used must be simple and practical.

A binder suitable for this work must be one that can be used cold. Our compounds HGR No. 1 and BICOMAC meet these conditions and stay put. They are a BOON to the MAINTENANCE MAN. We seek the trade of the MAINTENANCE MAN.

HEADLEY GOOD ROADS COMPANY

Thirtieth and Spruce Streets **Philadelphia, Pa.**

Missouri Indorses International Harvester Road Making Machinery

The picture above, showing Governor Major of Missouri standing just to the right of the Mogul tractor, was taken at the conclusion of an interesting road making demonstration in Marion County, Missouri.

After watching the work of the outfit, Governor Major said—"This equipment is the most rapid, complete, and thorough piece of road making machinery I ever saw. The work it does is the best I have ever seen. It revolutionizes road making on earth roads, and since 90 per cent of the roads in Missouri are earth roads, its value to a county cannot be over estimated."

This International Harvester outfit was chosen by the Marion County officials after a very trying demonstration in competition with a number of other makes of road grading outfits. After it became the property of the county, its work was done in such an efficient manner that a duplicate outfit was ordered.

Road builders and contractors will also find in the I H C line, stationary, portable and skidded engines in all sizes from 1 to 50 horse power, and all-purpose tractors ranging in size from 6-12 to 30-60 horse power.

Catalogues and full information will be sent cheerfully on request to any community interested in road improvement at reduced expense.

INTERNATIONAL HARVESTER COMPANY OF AMERICA

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181 Harvester Building **CHICAGO U S A**

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Pave with Brick

THE ROAD THAT REFUSES TO WEAR ITSELF OUT OR CALL FOR REPAIRS

A word to the wise ought to be sufficient—it was once. It may be the present day wisdom is different and it now takes **two words.**

Bad judgment in selecting the type of road needed to meet the demands of your traffic—will come home to you in a worn out road—with no money in sight for repairs. Thousands have made the same mistake. Will you let history repeat itself with you?

National Paving Brick Manufacturers Association

WILL P. BLAIR, Secretary **Cleveland, Ohio**

Concrete for Permanence

A Concrete Road, properly constructed, will outlive any Bond Issue or Guarantee

The above is a photograph of a model Concrete Road, built at Clarence, New York, by the New York State Highway Commission, under the direct supervision of Wm. Acheson, Division Engineer, Buffalo, N. Y.

KNICKERBOCKER PORTLAND CEMENT
was used exclusively

Seventy-five miles of KNICKERBOCKER
Concrete Roads in New York and New England

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**PERFECT
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For Heating and applying under Pressure
all varieties of Bituminous Materials, Hot or Cold for Road Construction,
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Also adapted for Street Flushing or Street Sprinkling

**WHEN NOT
REQUIRED
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TANK AND
ENTIRE
OILING
ATTACHMENT
MAY BE
REMOVED
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PURPOSES**

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**THE TRUCK
BEING IN
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Showing process of demounting Oiling
Attachments, requiring two men one-half hour's time

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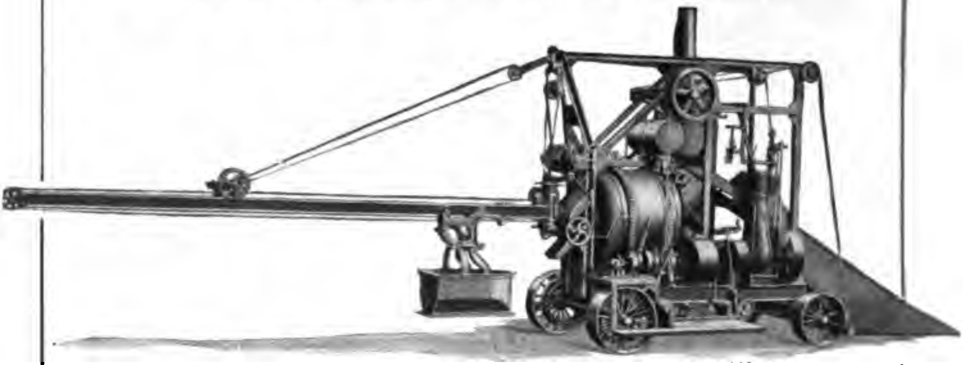
The Machine that Helps the Contractor Harvest a BIGGER CROP of PROFIT DOLLARS



Just remember this: You win two ways with a Koehring Mixer. In the first place, ***it helps you make big money*** by doing ***faster work*** and ***better work*** than any other outfit on the market, besides effecting a big cut in your labor costs. And what is just as important, ***it keeps you from losing money by sticking on the job*** every hour of every day, year after year!

You know that the mixer plays a mighty big part in your business. When the mixer stops, everything stops—***except your losses!*** And you also know that a good many mixers have the habit of "going wrong" just when they are needed the most.

Play safe! Make this year's profit-crop a sure one. Get a Koehring—the mixer that stands right up to its work under ***all*** conditions—stays on the job to the finish—cuts your costs, increases your profits and puts a quick stop to dangerous delay.

If you need a new mixer at all, you need the best your money can buy. And that means a Koehring, as we'll prove to you if you will write today for the Koehring Book of Facts—sent on request.

Koehring Machine Co.

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are:
1. Durability
2. Ease of cleaning—light resistance to traffic
3. Low first cost
4. Sanitariness
5. Ease of maintenance
6. Non-slipperiness
7. Favorableness to travel

The Concrete Road—

1st. Is the most durable of all roads with the exception of granite block.

2nd. Offers the least resistance to travel, giving a constant smooth surface to the wheels of traffic.

3rd. Is the least expensive of all hard surface roads costing ¼ to ⅓ less than brick.

4th. Containing in itself nothing which can decompose or become objectionable—it offers neither a porous surface or numerous joints for the collection of street refuse which speedily decays and becomes a menace to public health.

5th. Has the lowest maintenance expense of any road without exception, averaging around twelve to fifteen dollars a mile.

6th. Offers a firm foothold to horses because of its low crown and the possibility of making the surface any desired texture.

7th. The fact of a concrete road being perfectly smooth avoids irregularities in surface which are always a source of weakness and ultimate failure.

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BLOCKS

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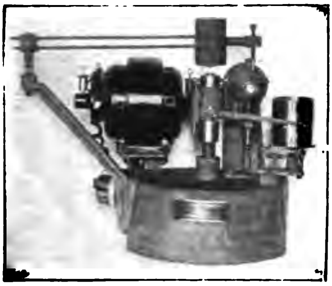

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Concrete for the Better Road

Illinois was one of the many states that wanted the best in roads. It was the concrete road—the road for permanence—that the Illinois State Highway Commission found to be the most economical in cost of up-keep.

Marquette Portland Cement

"The Certified Cement"

was specified and is now being used in the construction of these new concrete roads.

Build a concrete road; it's not affected by alternate freezing and thawing; heat does not soften the concrete; cold does not make it crack; it's the road for satisfaction; use Marquette Portland Cement for entire satisfaction.

Concrete for Permanence — Marquette for Concrete

Marquette Cement Manufacturing Company

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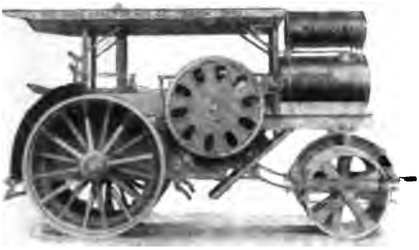
OHIO TRACTOR-ROLLER



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30 H.P. Double Cylinder Engine
also built in 12 and 15 ton sizes

Economy - Efficiency

4 Points of Merit

Powerful engine, adaptability, great draw bar pull, heavy gears.

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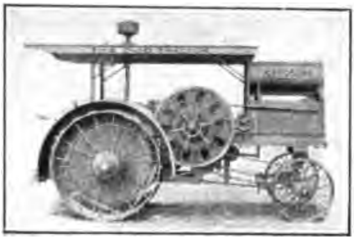

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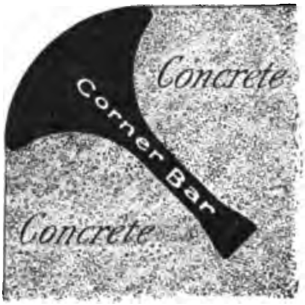

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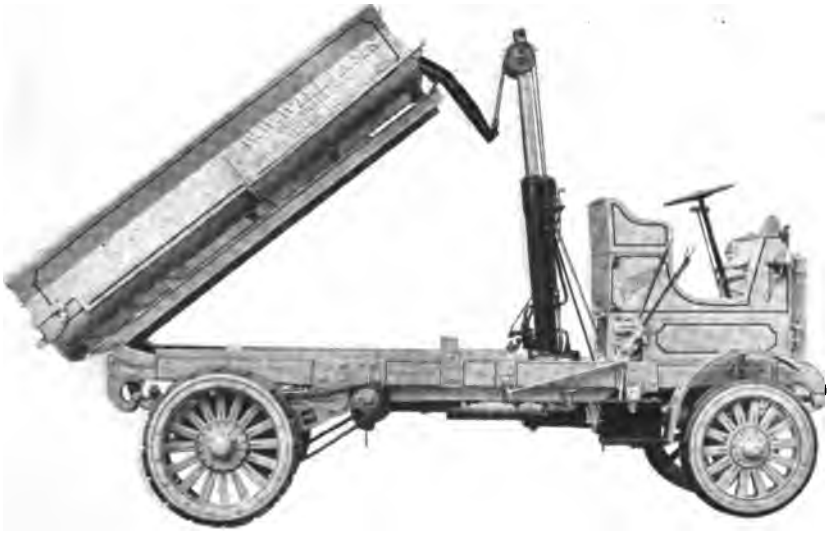

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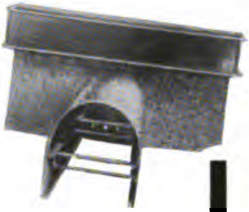

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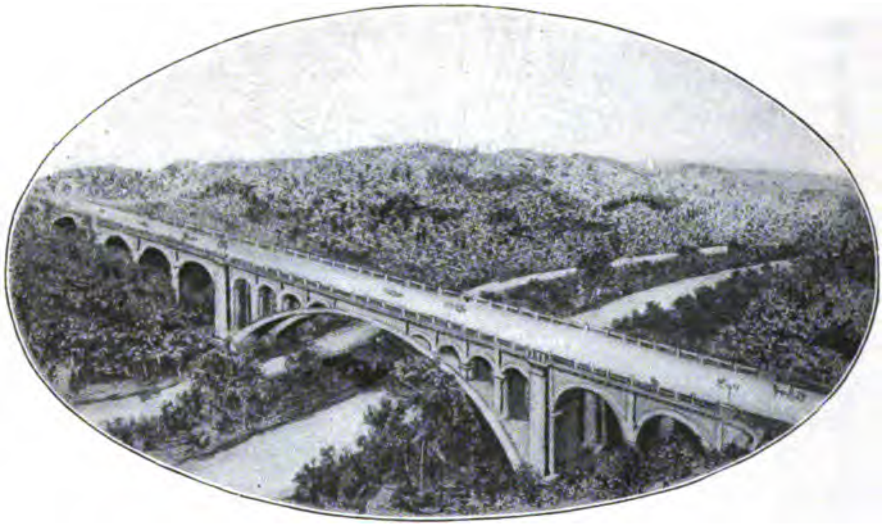

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HIGHWAY BRIDGES AND CULVERTS

The proper material to be used in the construction of a bridge or culvert depends almost wholly on local conditions, such as area of waterway required, character and amount of traffic, available funds, etc. For bridges of considerable span, steel is commonly used, though long arches of concrete, stone or brick are not unusual. For the shorter spans up to 30 or 40 feet, reinforced concrete is well adapted. Culverts are built of various materials, such as stone, brick, concrete, and pipe of cement, vitrified clay, corrugated iron, or cast iron. Wood is also frequently used, but the high cost of maintenance, and the inconvenience and discomforts attending periodic repairs or renewals make it a very undesirable material of which to construct highway bridges or culverts, and its use should be avoided.

Steel Bridges

Because of its toughness and great unit strength, steel is peculiarly well adapted for use in bridge construction. Cast and wrought iron were formerly much used for this purpose, but in recent years have been generally supplanted by steel.

A complete discussion of the subject of steel bridges would occupy too much space to be undertaken here. There are a few essential details, however, which may be profitably pointed out.

Design

The design of steel bridges is now almost an exact science, and most of the bridge companies doing business in this country are amply equipped for executing designs under any reasonable set of conditions that may be imposed. It is obviously bad practice, however, to invite bids for furnishing and erecting a proposed bridge from these companies upon their own plans, without first having prescribed a complete and definite set of conditions to which the designs must conform. Otherwise, in the absence of a standard of excellence, no adequate comparison can be made of the bids received. Also, irresponsible parties are likely to secure the contract by submitting low bids with very light designs. Provision should always be made for having bridge designs checked by a competent, disinterested designer.

Loading

The loading which a highway bridge should be designed to sustain depends in general on the local traffic conditions. Due allowance, however, should always be made for reasonable increases both in the amount of traffic and in the weight of concentrated loads. For rural bridges it is usually sufficient, in designing the floor system, to provide for a uniform live load of 125 pounds per square foot, or for a load of 20 tons concentrated on two axles 10 feet apart, with wheels spaced 6 feet on axles and with two-thirds of the load on the rear axle. In designing the trusses the uniform live load may be safely assumed as follows: For spans less than 50 feet in length, 125 pounds per square foot of floor surface; for spans between 50 and 100 feet in length, 100 pounds per square foot of floor surface; while for spans greater than 100 feet in length, the assumed uniform live load per square foot of floor surface may be reduced 2 pounds for each additional 10 feet in length of span, provided that in no case should the assumed uniform live load be less than 80 pounds per square foot of floor surface.

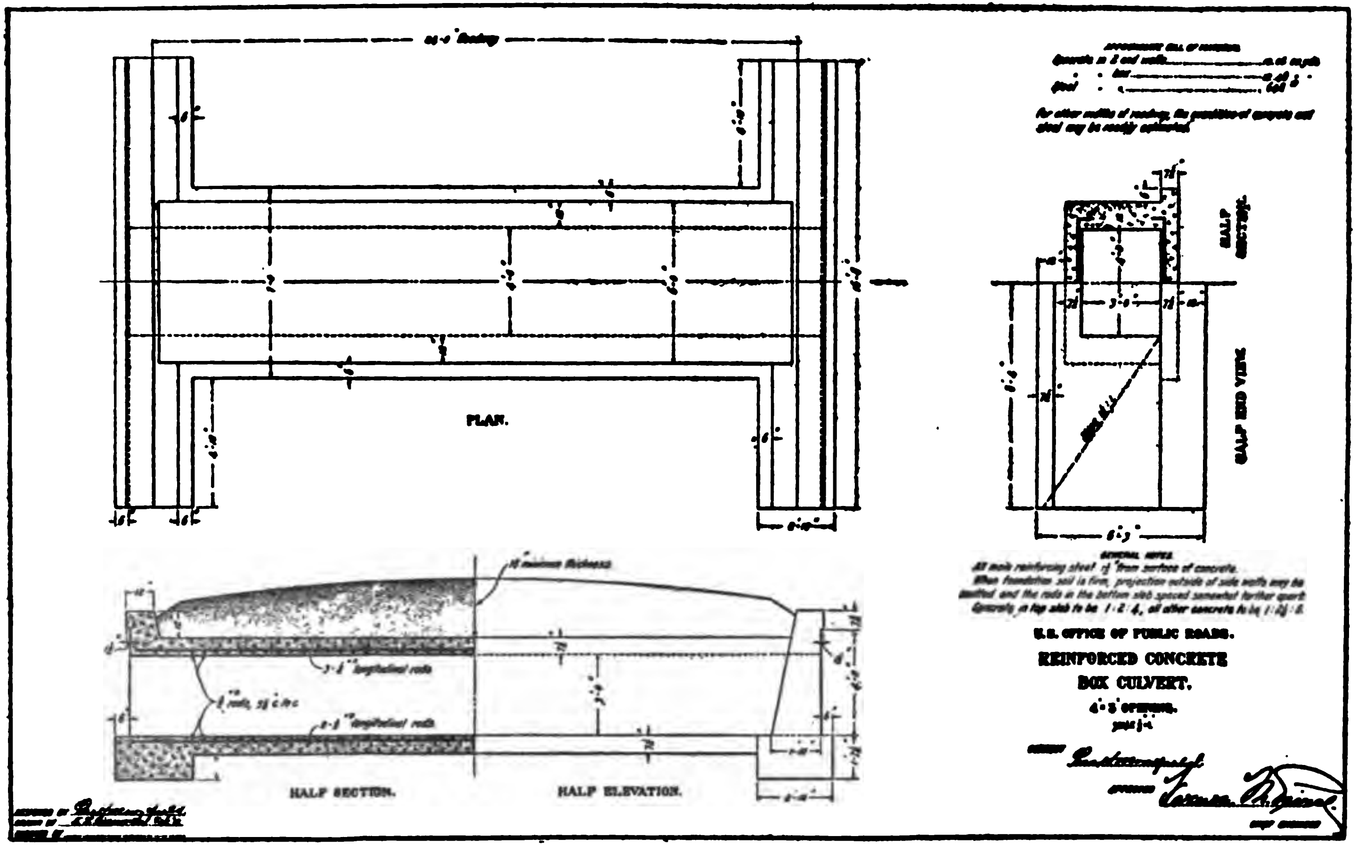
Piers and Abutments

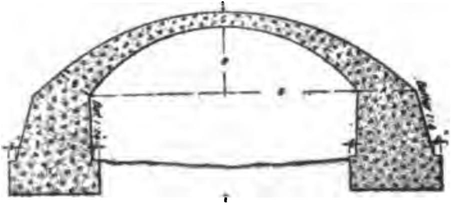
A large percentage of the bridge failures in this country have been due to umproperly designed abutments. There seems to be a general tendency to confuse the design of abutments with that of piers, and it is not unusual to see a bridge, consisting of a single span, supported on four slender cylindrical piers with no other provision for restraining the material of the approach embankment than wooden boards resting against these piers. There can be no objection to the use of properly designed cylindrical piers for supporting intermediate spans; but the abutment must serve a dual purpose. It is required to support the bridge and also to act as a retaining wall for the approach; and both of these functions should be considered in making the design.

Foundations for Piers and Abutments

In designing piers and abutments, the size of the footings should usually depend on the character of the foundation material. Investigations should, therefore, be made in the vicinity of each pier or abutment before the design is completed. The foundation may be tested by sounding with rods, by boring with wood augers, by sinking pipes with water jets or by drilling with a percussion drill.

When the character of the foundation material has been determined, its safe bearing capacity may be estimated from the following table, taken from U. S. Office of Public Roads Bulletin No. 43.

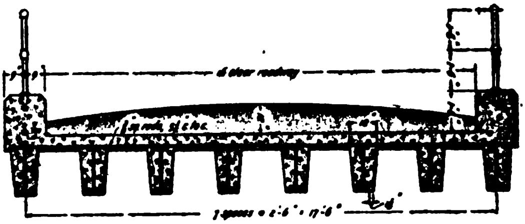

For other widths of roadway, the quantities of concrete and steel may be readily estimated.
PLAN.
HALF SECTION.
HALF END VIEW.
12" minimum thickness
HALF SECTION.
HALF ELEVATION.
GENERAL NOTES.
All main reinforcing steel 1½" from surface of concrete.
When foundation soil is firm, projection outside of side walls may be omitted and the rods in the bottom slab spaced somewhat farther apart.
Concrete in top slab to be 1:2:4, all other concrete to be 1:2½:5.
U.S. OFFICE OF PUBLIC ROADS.
REINFORCED CONCRETE
BOX CULVERT.
4'×3' OPENING.



TYPICAL SECTION PLAIN CONCRETE ARCH.
Concrete in superstructure 1:2:4. In abutments and wing walls 1:2½:5.
For intermediate spans, the dimensions may be obtained by interpolation.

DIMENSIONS

Span = S	R	C	B	A
6'-0"	2'-0"	0'-9"	1'-0"	1'-0"
10'-0"	3'-0"	0'-9"	1'-10"	3'-6"
20'-0"	5'-0"	1'-1"	2'-9"	5'-3"
30'-0"	7'-6"	1'-6"	3'-9"	6'-0"

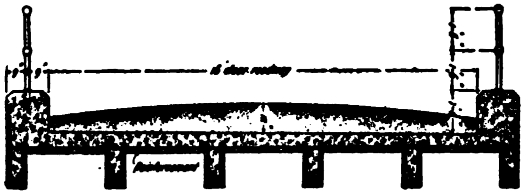


TYPICAL SECTION ENCASED I-BEAM BRIDGE.

DIMENSIONS

Span	Std. I	Span	Std. I	Span	Std. I
10'	8"-18 lb.	18'	12"-31½ lb.	26'	18"-55 lb.
12'	9"-21 lb.	20'	15"-42 lb.	28'	18"-55 lb.
14'	10"-25 lb.	22'	15"-42 lb.	30'	18"-55 lb.
16'	12"-31½ lb.	24'	15"-42 lb.		

Side channels to be the lightest standard channels of the depth specified for the I's.
Concrete in superstructure to be 1:2:4.



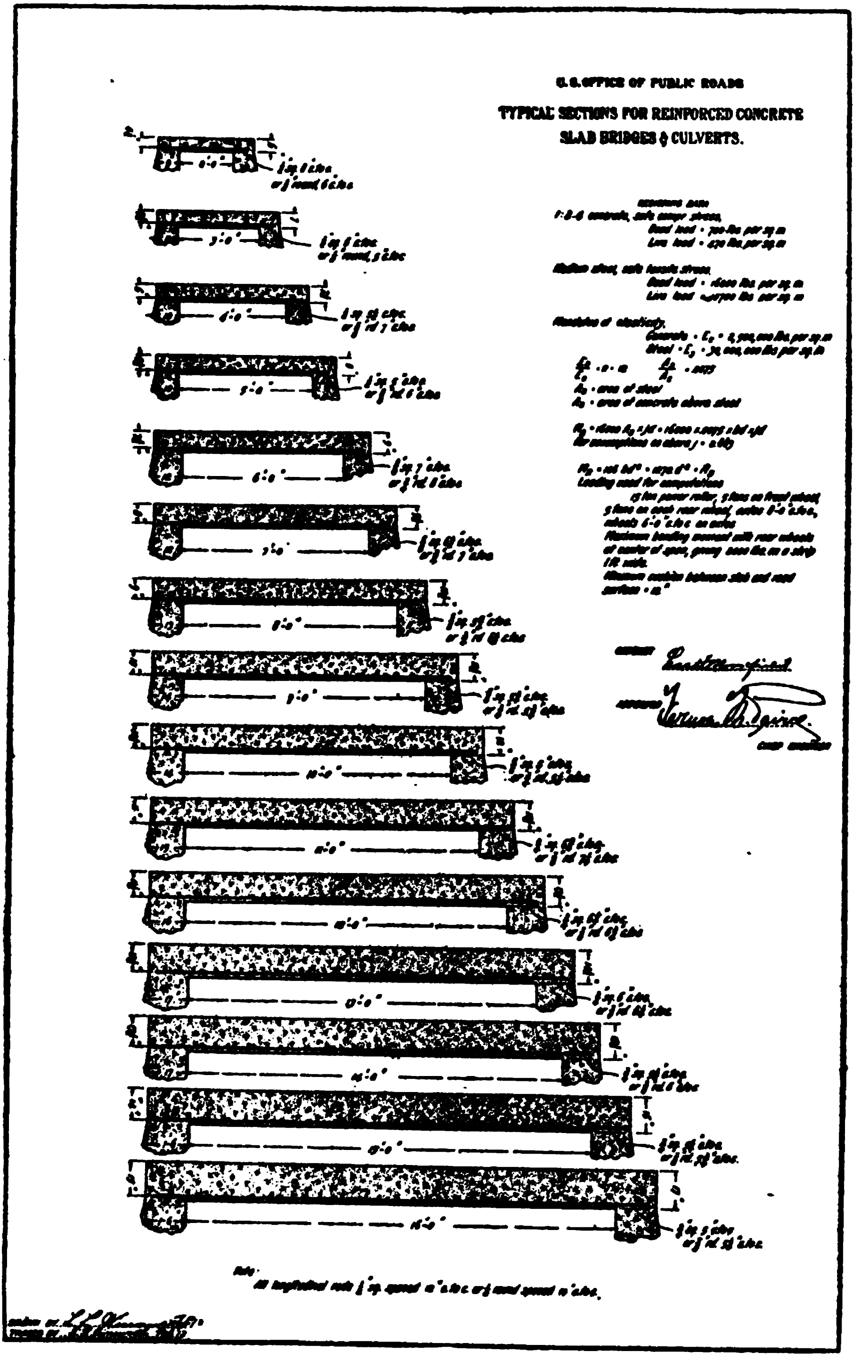
TYPICAL SECTION REINFORCED CONCRETE T-BEAM BRIDGE.
Concrete in superstructure to be 1:2:4.

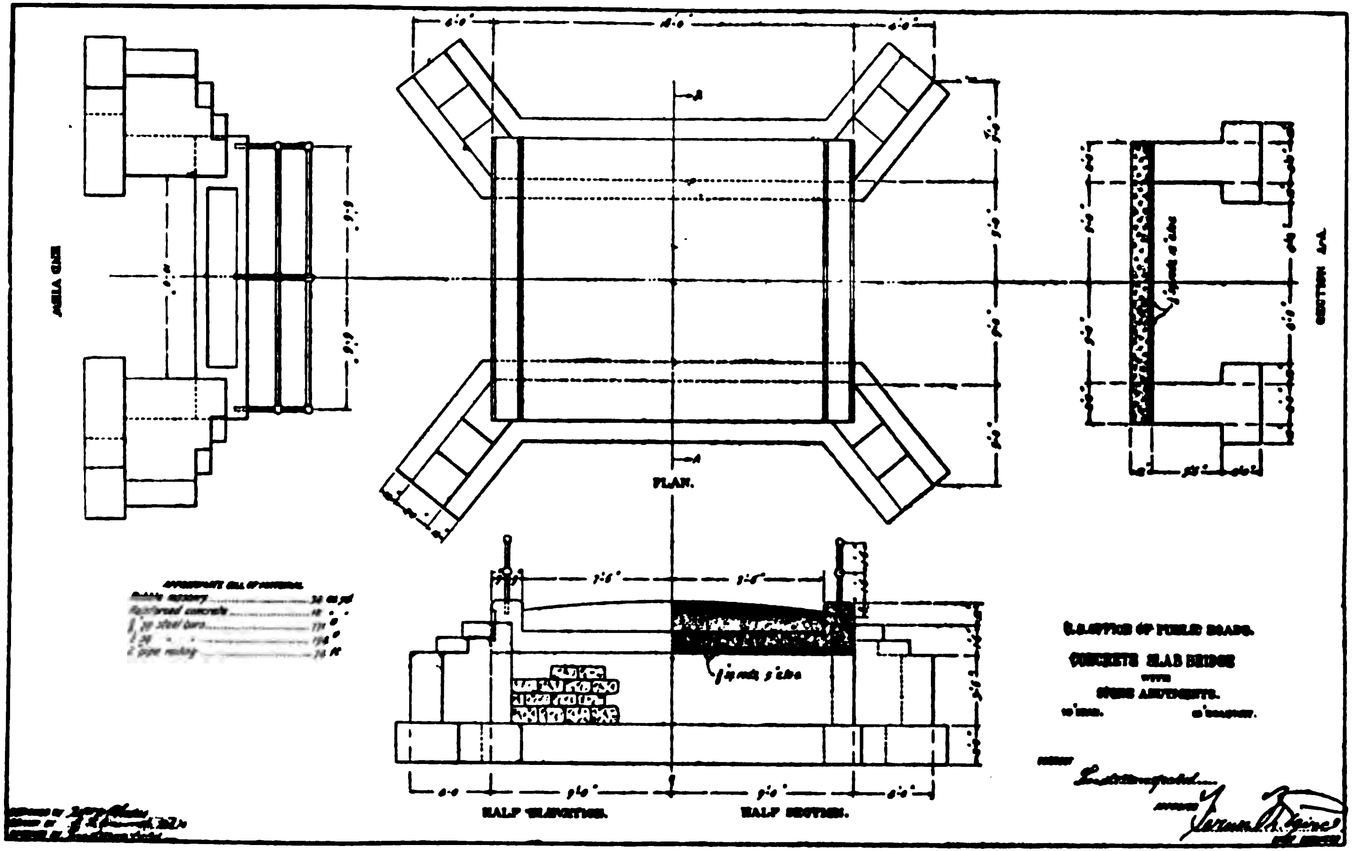
U.S. OFFICE OF PUBLIC ROADS.

TYPICAL SECTIONS FOR SHORT SPAN CONCRETE BRIDGES.

Correct
Approved
Chief Engineer

Drawn by
Traced by


U.S. OFFICE OF PUBLIC ROADS
TYPICAL SECTIONS FOR REINFORCED CONCRETE
SLAB BRIDGES & CULVERTS.
10'-0"


END VIEW
PLAN.
A
A
HALF ELEVATION.
HALF SECTION.
SECTION A-A
APPROXIMATE BILL OF MATERIAL.
Rubble masonry .... 34 cu. yd
Reinforced concrete
steel bars
pipe railing
U.S. OFFICE OF PUBLIC ROADS.
CONCRETE SLAB BRIDGE
WITH
STONE ABUTMENTS.
SPAN.
ROADWAY.

Material	Bearing power (tons per square foot)
Quicksand and wet soils	0.05 to 1
Dry earth	1 to 1.5
Moderately dry clay	2 to 4
Dry, stiff clay	4 to 6
Sand	2 to 4
Sand, compact and cemented	4 to 6
Gravel, cemented	8 to 10
Rock	200

Where the material of the foundation is poor, as, for example, wet clay or quicksand, it is customary to increase its bearing power by making use of piles, which are driven to such depth as is necessary to prevent settling after the weight of the whole structure is superimposed, the piles being considered as carrying the entire load. The formula in most general use for determining the amount of driving necessary to produce this condition is that proposed by the *Engineering News*, $P=\frac{2WH}{S+1}$, in which P is the safe load in pounds on one pile, W the weight of the hammer in pounds, H the fall of the hammer in feet, and S the penetration or sinking in inches under the last blow.

Floors

Highway bridge floors are made of wood, reinforced concrete or steel. Wood floors are probably the most common, but reinforced concrete presents many advantages over wood for this purpose, and is becoming very popular. Wood floors on old bridges, however, should never be replaced by concrete, unless the change was anticipated in the original design. Neither should the thickness of the wood floor be much increased, as any additional weight put on the structure for which provision has not been made is likely to prove disastrous.

The economical thickness of wood floors depends on traffic and climatic conditions, as well as on the quality of the wood. In general, it should be such that the wood will have practically worn out before being destroyed by decay. This economical thickness varies from 2½ to 4 inches.

Concrete or steel floors should always be protected from the traffic by cushion of earth or macadam.

Painting

Steel bridges should ordinarily be repainted about once every three years. If this work is neglected, as is so frequently the case, rust soon makes inroads into the metal, impairing both its strength and appearance.

Concrete Bridges and Culverts

Concrete bridges and culverts should be designed to sustain the same live loads as those indicated above for steel bridges.

The proper type of superstructure to adopt for any particular case should usually depend on local conditions. For example, where sufficient head room and satisfactory foundation can be obtained, an arch may be advantageously used. Where head room is limited or the foundation poor, however, it may frequently be necessary to make the superstructure flat. Also, flat slab superstructures are ordinarily used for spans less than about 14 feet in length, as little, if any, saving can be effected by using an arch. Where appearances are of prime consideration, however, an arch may properly be used, even at additional cost.

There are three types of flat reinforced concrete superstructures in general use which are respectively known as the slab type, the encased I-beam type, and the T-beam type. Each of these types may be used with either stone or concrete abutments.

The slab type is practicable only for spans less than about 16 feet in length. Culverts and bridges of this type are very easily constructed, and require very little skilled labor.

The encased I-beam type of superstructure is well suited for spans from 10 feet to 30 feet in length. In this type, the steel beams are designed to carry the entire load, though the concrete casing undoubtedly increases the strength of the structure.

The T-beam type is adapted for about the same range of spans as the I-beam type, though T-beams can be used for somewhat longer spans. When used for spans over 30 feet in length, however, the economy of employing them should be demonstrated for each particular case. The construction of T-beam bridges and culverts is more difficult than either of the other types and requires more skilled labor. The cost of materials, however, is, in general, somewhat less.

The accompanying illustrations, which have been prepared from data contained in Bulletin No. 45 of the U. S. Office of Public Roads, show how the various types of concrete superstructures are designed, and also show typical designs for a 4 foot by 3 foot box culvert, and a 10 foot span slab bridge on stone abutments.

Pipe Culverts

Vitrified clay, cast iron, corrugated iron, steel plate and concrete pipes are used for the smaller culverts. Up to 24 inches in diameter pipe culverts are usually economical and the pipes are easily handled and laid. They should be laid true to grade and on a firm foundation. Headwalls of concrete, brick or stone should be constructed at each end, extending high enough to carry the fill and low enough to avoid damage by frost.

Cast Iron Pipe Culverts

Cast iron pipe has been satisfactorily used for culverts for many years, and while not as cheap per foot, nor as easily handled as some of the lighter metal culverts, its claim to durability can not be questioned. Some of the cast iron pipe culverts placed in Paris over three hundred years ago are still in service and apparently in a fair state of preservation.

Cast iron pipe for highway culverts is usually made in 12-foot lengths, and can be obtained in various diameters from foundries in almost every part of the country.

Sectional Cast Iron Culverts

The sectional cast iron culverts possess features which tend to make them desirable in highway work. With their flattened oval base, they are said to have greater freedom from clogging. Their locked joints holds them intact. It is claimed that their headwalls hold the roadbed in shape thus allowing a shorter length of culvert to be used. It is also claimed that their form gives them greater strength than the round structures possess, as well as facilitating easy handling and consequent saving in transportation and that they may be assembled by unskilled labor. They make good culverts for highways.

Corrugated Metal Culverts

Many culverts are now being constructed of corrugated galvanized iron or steel sheets. The corrugations are designed to so strengthen the sheet as to reduce the danger of collapse. This form of culvert has come into extended use during the past eight or ten years largely on account of the fact that it is easily installed and does not require the close supervision which is necessary for many other types of highway drainage.

The pipe should, however, be made to conform to proper requirements for fabrication, rivetting, etc.; should be made from a sufficiently heavy gauge of metal to insure strength for the diameter of pipe required; and should be sufficiently and properly galvanized. In the best practice, such culverts are installed with concrete or masonry headwalls.

Vitrified Clay Culvert Pipe

In localities where the ground does not freeze to great depths, vitrified clay pipe has proved satisfactory as a culvert material. It should be double strength, hard burned, and salt glazed. Each pipe should be a true cylinder, free from cracks, and have a thickness of shell of at least one-twelfth of the internal diameter. In laying the culvert, care should be taken to round out the bottom of the ditch to fit the pipe, making suitable depressions for the bells. Where rock occurs in the ditch, it should be excavated some 6 inches below the lower surface of the pipe and replaced with clay or sand. In very cold climates, the pipe should be completely covered with sand or broken stone for a depth of at least 6 inches. Where earth comes directly in contact with the pipe, danger from freezing is considerably increased. The surface of the roadway should never be less than 1½ diameters above the top surface of the pipe.

Importance of Engineering Supervision

Before leaving the subject of bridges and culverts, attention should be called to the importance of having the design and construction of all such structures executed under the immediate supervision of a competent engineer. In no other feature of highway improvement can technical training be employed to better advantage. Not only the efficiency of the structure itself is involved, but human safety is not infrequently dependent on its proper design and construction.

MASSACHUSETTS SPECIFICATIONS FOR HIGHWAYS

Specifications common to the following types: *broken stone and bituminous surfacing* (tar grouting method); *broken stone and bituminous surface* (double penetration method); *broken stone and bituminous surface* (mixed method).

Section 10. Broken stone consisting of trap rock or rock which, in the opinion of the engineer, is equal to trap rock shall be spread and rolled on the road bed prepared as herein described, as follows:—

The width of the broken stone shall be eighteen (18) feet.

The lower course shall consist of stones that will pass through a ring two and one-half (2½) inches in diameter and will not pass through a ring one and one-quarter (1¼) inches in diameter, and shall be four (4) inches deep in the centre and four (4) inches deep at the sides after rolling.

The lower course shall be shaped to a true section conforming to the proposed cross-section of the highway and thoroughly rolled.

Any depressions or irregularities which may occur shall be filled with smaller stones as directed by the engineer, and again rolled until the surface is true and unyielding. The interstices in this course shall then be filled with clean sharp sand, and after being thoroughly rolled dry the sand shall be just below the top of the broken stone as directed by the engineer, and no sand shall be left on top of the stones.

If at any time before the acceptance of the work any soft or imperfect places or spots develop in the surface, all such places shall be removed and replaced with new material and then rolled until thoroughly compacted and until the joints or edges at which the new work connects with the old become invisible. All such removal and replacing of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the engineer, unfavorable to obtaining satisfactory results.

SPECIFICATIONS SUPPLEMENTAL TO THE ABOVE

Broken Stone and Bituminous Surfacing

Tar grouting method. Upon the lower course shall be spread the upper course of stone which shall consist of stones that will pass through a ring one and one-quarter (1¼) inches in diameter, but will not pass through a ring one-half (½) inch in diameter, and shall be two (2) inches in thickness after rolling with a steam roller and evened up with material of the same size and quality as has been used in that particular course and to the satisfaction of the engineer.

Upon the upper course of stone, prepared as hereinbefore described, refined tar shall be uniformly applied with a pressure-machine at the rate of one and one-half (1½) gallons to each square yard of surface, and immediately covered with clean trap pea stone and then thoroughly rolled. A second application of refined tar shall then be made in the same manner as in the first application at the rate of one-half (½) gallon per square yard and immediately covered with clean trap pea stone and then thoroughly rolled.

In distributing the tar no overlapping shall be allowed.

The contractor shall sprinkle the road with water when and as directed by the engineer.

All depressions in any course shall be filled with the same material used in that particular course and shall be rolled until a smooth, true and unyielding surface is obtained.

The bituminous binder shall consist of refined tar and when applied to the road surface it shall have a temperature approximating 200°F.

The sand used to bind the broken stone in the lower course shall be clean, sharp and free from loam, clay, and adventitious matter of all kinds.

It shall contain no pebbles which will not pass through a one-half (½) inch mesh nor practically any grains or particles which will pass through a screen of thirty (30) meshes to the linear inch.

The commission will order the tar when requested so to do by the contractor.

The contractor is to be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the tar at the railroad delivery selected.

The contractor is to heat the tar in tank cars or otherwise, team the tar to the site of the work, and apply thereon as specified without compensation additional to the price paid per gallon for bituminous surfacing.

Double penetration method. The new broken stone in this lower course shall be spread from carts by hand, or from a dumping board.

Upon the surface prepared as hereinbefore described heavy asphaltic oil shall be uniformly applied with a pressure machine at the rate of five-eights (⅝) of a gallon to each square yard of surface.

Immediately after the application of the oil a course of stone consisting of broken trap rock in sizes varying from one-half (½) inch to one and one-quarter (1¼) inches in their longest dimensions shall be applied by spreading by hand from piles previously distributed on the side of the road, the course to be one (1) inch in thickness after rolling.

A second application of the oil shall then be made in the manner previously described and at the rate of five-eighths (⅝) of a gallon to each square yard of surface.

Immediately after this second application of oil a course of stone of the same sizes as in the first application shall be lightly spread in quantity sufficient to cover the oil, and then thoroughly rolled; after which, a third application of oil shall be made in the manner previously described at the rate of one-quarter (¼) of a gallon to each square yard of surface, immediately covered with clean trap rock pea stone, and then thoroughly rolled.

The bituminous binder shall consist of asphaltic oil and when applied to the road surface, it shall have a temperature approximating 250° F.

The sand used to bind the broken stone in the lower course shall be clean, sharp, and free from loam, clay, and adventitious matter of all kinds.

It shall contain no pebbles which will not pass through a one-half (½) inch mesh, nor practically any grains or particles which will pass through a screen of thirty (30) meshes to the linear inch.

In distributing the oil no over-lapping shall be allowed.

The contractor shall sprinkle the road with water when and as directed by the engineer.

All depressions in any course shall be filled with the same material used in that particular course, and shall be rolled until a smooth, true and unyielding surface is obtained.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

The Massachusetts Highway Commission will furnish all asphaltic oil necessary in tank cars at the railroad freight station nearest to the site of the work.

The commission will order the oil when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the oil at the railroad delivery selected.

The contractor is to heat the oil in tank cars or otherwise, team the oil to the site of the work, and apply thereon as specified, without compensation additional to the price paid per gallon.

Mixed method. On the lower course of broken stone, prepared as hereinbefore specified, shall be spread according to lines and grades given by the engineer, the bituminous mixture, which shall consist of trap rock broken stone mixed with Bermudez Road Asphalt; the sizes of stone, proportions of stone and of asphalt, and method of mixing and spreading to be as hereinafter described.

The bituminous mixture shall be laid in one course and shall be, after rolling, two (2) inches in thickness.

The broken stone shall vary in size from one-quarter (¼) inch to one and one-quarter (1¼) inches and no stones larger than one and one-quarter (1¼) inches in their longest dimensions shall be used. All broken stone used shall be absolutely clean and free from adventitious matter.

When the broken stone has been heated to not less than 150°F., or more if the engineer so requires, it shall be mixed with the asphalt by machines, which shall be approved by the engineer, and as the engineer may direct, until all particles of stone are covered with asphalt.

Sixteen (16) gallons of asphalt measured at temperature of the air shall be mixed with each cubic yard of stone.

Before mixing with the stone, the asphalt shall be carefully heated to not less than 350°F. and at that temperature shall be mixed with the stone. No asphalt shall be used after it has been injured by overheating or burning. The contractor shall heat the asphalt in suitable kettles satisfactory to the engineer.

After being properly prepared as hereinbefore stated, the mixture shall be teamed to the road and spread before it has cooled to a temperature below 100°F.

The mixture shall be dumped on steel dumping platforms or shovelled directly from the cart into place. As the spreading is done rakes shall be used to obtain a uniform distribution of stones and an even surface before rolling.

The mixture, after being satisfactorily spread and raked, shall be at once rolled with a tandem roller, weighing not less than seven (7) tons, care being taken not to push the mixture out of place by the roller, but to roll so as to lay it down, compressed to a perfect cross-section, and true to line and grade. During very hot weather the rolling shall be postponed until cool enough to roll without pushing out of place and shape.

If any unevenness or depressions appear during or after rolling the bituminous mixture, suitable material (mixed), satisfactory to the engineer shall be added, and rolled in a manner to remove all such unevenness or depressions.

Immediately after the bituminous mixture is rolled to a firm surface and free from irregularities, a seal coat of Bermudez Asphalt shall be so applied as to completely cover the surface, using one-third (⅓) of a gallon of asphalt per square yard of surface. It shall be carefully spread with "Squeegees" or brooms.

Immediately after it has been spread it shall be covered with clean trap rock pea stone and rolled until the pea stone is bonded with the asphalt of the seal coat.

No teaming or travel of any kind shall be allowed to pass over the new surface until twenty-four hours have elapsed after the final rolling, or until the surface has become sufficiently hardened to prevent injury by picking up or tracking.

In order to provide for passing traffic during the progress of the work it will be necessary to construct only one-half of the width of the roadway at one time. The bottom course of that portion of the roadway which shall first be laid shall be extended two (2) feet beyond the centre of the road or two (2) feet beyond the inside edge of the bituminous mixture so as to provide a firm base for the bituminous mixture, also to satisfactorily bond into the remaining portion of the bottom course when laid.

The bituminous mixture and sealing coat of that portion first laid shall lap over the line of the joint at the centre of the roadway, so that when the second half is laid the first half can and shall be cut back to a uniform longitudinal line and perfect vertical section so as to obtain a perfect joint and cross-section.

From the time of commencement of laying the bituminous mixture during and until the time the final covering of pea stone is spread on the seal coat, the adjoining surface on any or all sides of the portion under construction shall be kept watered as directed by the engineer to prevent dust alighting on the bituminous surface.

The commission will furnish all Bermudez Asphalt in barrels in cars at the railroad siding requested by the contractor.

The contractor shall be responsible for any and all railroad charges and for any loss or damage to material after the delivery of the asphalt at the railroad siding.

The contractor shall at his own expense team the asphalt to the work, store it and protect it from the weather to the satisfaction of the engineer.

Bituminous Wearing Course

Hot oil blanket. Section 10a. After the macadam road has been finished as herein described, the surface shall be swept with brooms, or a horse sweeper, approved by the engineer, and so as to fully expose the stones of the upper course and to remove to a slight extent the binder between them. If directed by the engineer, the road shall then be watered slightly. Upon the surface for the full width of the macadam the bituminous binder hereinafter described shall be applied in a thin film, the bituminous material shall be heated to a temperature hereinafter stated, and distributed evenly by means of a pressure machine approved by the engineer, so designed as to enable its operator to control the flow and to distribute the material uniformly, under a pressure of not less than thirty (30) pounds per square inch, leaving no streaks or spots, and so designed as to enable its operator to "cut out" any portion of the roadway and to avoid any surplus deposit of the binder on the roadway or elsewhere. If the engineer shall so direct the bituminous binder shall also be further distributed by means of soft brooms or "squeegees." For this portion of the work not more than one-quarter (¼) of a gallon of said material to the square yard of surface shall be required.

As soon as may be after the application of the bituminous binder, as above specified, a thin layer of sand shall be distributed evenly thereon in sufficient quantity to absorb all surplus oil and form a true surface. This surface shall be thoroughly rolled, and, if desired by the engineer, slightly watered, after which oil shall be again applied in the same manner hereinbefore stated, at the rate of one-quarter (¼) of a gallon to the square yard of surface.

As soon as may be after the application of the bituminous binder, as above specified, a thin layer of sand shall be distributed evenly thereon to such a depth that after rolling no surplus binder shall appear upon the surface of the roadway, and so that there shall be a wearing course of the sand combined with the bituminous binder of a total depth approximating one-half (½) inch.

The sand used shall be clean, sharp and dry, free from loam, clay and adventitious matter of all kinds. It shall contain no pebbles which will not pass through a one-half (½) inch mesh, nor practically any grains or particles which will pass through a screen of thirty (30) meshes to the linear inch.

The bituminous binder shall consist of asphaltic oil, and when applied to the road it shall have a temperature approximating 250°F.

The completed surface of the roadway shall be smooth, conforming to the profile and cross-section, and free from hollows or depressions, and if at any time before the acceptance of the work spots or streaks appear, indicating a deficiency or a surplus of the bituminous binder, the surface shall be again treated with more of the binder or sand, as the case may be, and if directed by the engineer, the surface shall be lightly watered and thoroughly rolled.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are in the opinion of the engineer unfavorable to obtaining satisfactory results.

The Massachusetts Highway Commission will furnish all asphaltic oil necessary in tank cars at the railroad freight station nearest to the site of the work. The commissioner will order the oil when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges, and for any loss or damage to material that may accrue after the delivery of the oil at the railroad delivery selected.

The contractor is to heat the oil in tank cars or otherwise, team the oil to the site of the work, and apply thereon as specified without compensation additional to the price paid per gallon.

Shaping surface for sand and oil. Section 9. Before the sand and oil is spread the roadbed shall be shaped to a true surface conforming to the proposed cross section of the highway and rolled by a six ton roller, unless otherwise ordered by the engineer.

All depressions occurring must be filled with suitable material and again rolled until the surface is smooth and hard. The cost of shaping and rolling the roadbed shall be included in the price paid for excavation and for furnishing the material used, and shall not be additional thereto.

When, in the opinion of the engineer, it is necessary to place hardening material on the subgrade of the road, before the sand and oil is laid, the contractor shall spread clay or other material satisfactory to the engineer and roll the same in such manner as is satisfactory to the engineer, and with such weight of roller as he may direct.

Sand and oil mixed. Section 10. Upon the road bed prepared as described in section 9, the sand and oil surfacing shall be applied, as follows:

The sand and oil shall be mixed by hand or with a mechanical mixer, or by other means furnished by the contractor, provided the method employed is approved by the engineer. If the mixing is done by hand, it shall be done on tight platforms to be furnished by the contractor, the platforms to be made of two (2) inch plank, about sixteen (16) feet in length, and in two sections, each about four (4) feet in width.

The contractor shall furnish and operate at least four (4) mixing platforms and four (4) heating kettles or tanks, and a sufficient number of sand heaters, and if in the opinion of the engineer the work is not proceeding with sufficient rapidity to insure its completion within the time specified in the contract, the contractor shall furnish and operate a sufficient number of additional platforms, kettles and sand heaters to insure the work being so completed within the specified time.

The kettles or tanks for heating the asphaltic oil shall be of a design satisfactory to the engineer, and of a capacity of not less than sixty (60) gallons each.

The sand shall be dry and so heated that when mixed with the oil a uniform mixture will be secured. Care must be taken not to overheat the sand so as to burn the oil.

The sand and oil shall be mixed in batches of approximately one (1) cubic yard, the sand being spread upon the mixing platform and the hot oil poured upon it and the whole mass thoroughly turned with shovels, hoes, or rakes, until each particle of sand is completely covered with oil, about sixteen (16) gallons of oil being required for one (1) cubic yard of sand as measured loose in measure box.

The oil when mixed with the sand shall be hot enough to secure a good mixture, and shall be of a temperature between 250°F. and 375°F., depending on nature of oil used.

When the mixture is completed to the satisfaction of the engineer, it shall not be dumped upon the subgrade, but it shall, without delay, be spread while still warm upon the subgrade from a dumping board, or from a plate of sheet iron satisfactory to the engineer, to a width of sixteen (16) feet, and to a depth of three and one-half (3½) inches at the centre and sides, after rolling with a tandem roller weighing approximately six (6) tons.

After the mixed material is deposited in place and shaped with rakes, etc., it shall, before it hardens, be rolled with a horse roller weighing about one (1) ton, then shaped with a road machine or with a suitable scraper, and afterwards rolled with a tandem roller to the satisfaction of the engineer. A hand roller weighing about two hundred (200) pounds may be used before rolling with the horse roller, if preferred.

If any depressions appear after scraping and rolling the sand and oil mixture, suitable mixed material satisfactory to the engineer shall be added. If such depressions are found after the sand and oil has hardened so that the new mixture will not readily bond with the old, the old mixture shall be dug out to a depth satisfactory to the engineer and the new material added. Any slight unevenness of the surface shall be remedied by scraping with a road machine or a suitable scraper, and the surface shall then be rolled in a manner to remove all such depressions and leave a smooth and even surface.

After the sand and oil mixture is rolled to a firm surface, free from all irregularities and all surplus loose material, a seal coat of asphaltic oil shall be distributed in two applications at the rate of one-quarter (¼) of a gallon per square yard of road surface for each application. Each application of oil so applied shall be uniformly covered with a thin layer of sand and rolled to the satisfaction of the engineer.

The asphaltic oil, when applied to the road surface, shall have a temperature approximating 350°F.

If so ordered by the engineer the thickness of the sand and oil mixture shall be increased or diminished at such points as he may direct.

The sand shall be clean, sharp, and dry, free from loam, clay and adventitious matter of all kinds. It shall contain no stones larger than one-half (½) inch in their longest dimensions, nor practically any grains or particles which will pass through a screen of fifty (50) meshes to the lineal inch.

The finished surface of the road shall present such crown as shall be directed by the engineer.

In distributing the oil no over-lapping shall be allowed.

The contractor shall sprinkle the road with water when and as directed by the engineer.

All depressions in any course shall be filled with the same material used in that particular course and shall be rolled until a smooth, true and unyielding surface is obtained.

If at any time before the acceptance of the work any soft or imperfect places or spots shall develop in the surface, the material at all such points shall be removed and replaced with new material, and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature, or otherwise, are, in the opinion of the engineer, unfavorable to obtaining satisfactory results.

The Massachusetts Highway Commission will furnish all asphaltic oil necessary for mixing in barrels and for sealing coat in tank cars at the railroad freight station nearest to the site of the work.

The commission will order the oil when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the oil at the railroad delivery selected.

The contractor is to heat the oil in tank cars, or otherwise, team the oil to the site of the work, and apply thereon as specified, without compensation additional to the price paid per square yard for bituminous surfacing.

Sand and Oil Surface

Layer Method. Section 10. Upon the roadbed prepared as described in Section 9 shall be applied asphaltic oil by the layer method, if so directed by the engineer, for a width of sixteen (16) feet, by means of a distributor, so arranged as to enable the operator to control the flow and distribute the oil equally and uniformly, leaving no spots or streaks uncovered and to avoid spreading a surplus of oil at any point, and to completely control the quantity of oil delivered on the road.

The oil shall be spread on the road at a temperature not greater than 250°F., and not less than 180°F., and shall be so heated as to insure its delivery on the road at the required temperature.

There shall be three applications of oil the quantity for each application to be on the average not less than two-thirds (⅔) of a gallon per square yard.

After the first application of oil has been made and as soon thereafter as the engineer may direct, a layer of sand shall be uniformly spread thereon of sufficient depth to insure a thickness of approximately one (1) inch after rolling.

As soon thereafter as the engineer may determine, the second and third applications of oil and sand shall be applied in the same manner as in the first application and to the satisfaction of the engineer.

After three layers of oil and sand have been applied in the prescribed manner, the road shall be rolled by a roller of such size and weight as the engineer may determine.

During the rolling, sand shall be applied to absorb any oil which may flush to the surface, and in such quantities as the engineer shall direct.

After the rolling has been completed to the satisfaction of the engineer, a thin layer of sand shall be spread evenly over the entire oiled surface.

All sand shall be clean, sharp and free from loam, clay and adventitious matter of all kinds and shall meet with the approval of the engineer.

All depressions in any course shall be filled with the same material used in that particular course and shall be rolled until a smooth, true and unyielding surface is obtained.

If at any time before the acceptance of the work any soft or imperfect places or spots shall develop in the surface, the material at all such points shall be removed and replaced with new material and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise, are, in the opinion of the engineer, unfavorable to obtaining satisfactory results.

The Massachusetts highway commission will furnish all asphaltic oil necessary in tank cars at the railroad freight station nearest to the site of the work.

The commission will order the oil when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the oil at the railroad delivery selected.

The contractor is to heat the oil in tank cars or otherwise, team the oil to the site of the work, and apply thereon as specified without compensation additional to the price paid per square yard for bituminous surfacing.

HIGHWAY OFFICIALS

Office of Public Roads, United States Department of Agriculture.—Logan Waller Page, director; P. St. J. Wilson, assistant director; Vernon M. Peirce, chief engineer; J. E. Pennybacker, chief of road economics; E. J. James, chief division of maintenance; T. Warren Allen, chief of national park and forest roads; E. B. Mc Cormick, testing engineer; C. S. Reeve, chemist; W. C. Wyatt, chief clerk.

Alabama

State Highway Commission.—Robert E. Spragins, chairman; John Craft, Julien Smith, Dr. Eugene A. Smith, State geologist, University of Alabama; G. N. Mitcham, professor of engineering, Alabama Polytechnic. Institute; W. S. Keller, State highway engineer, Montgomery; R. P. Boyd, assistant State highway engineer.

County commissioners or boards of revenue elected by the people of each county in November of even years, have supervision over the roads. They divide the county into road precincts and appoint apportioners, who in turn appoint a road overseer for each precinct.

A county supervisor of roads to receive not more than $5 per diem, may be appointed by county commissioners, and, in acts allowing bond issues, it is usual to provide that county commissioners may appoint an engineer and fix his salary.

Alaska

Road work is under supervision of board of road commissioners of Alaska, composed of officers of the corps of engineers, U. S. A., upon whose recommendations appropriations are made by Congress.

Lieutenant-Colonel W. P. Richardson, U. S. A., president of board; Lieutenant Glen E. Edgerton, C. E., U. S. A., engineer officer, Valdez.

Arizona

Board of Control.—Geo. W. P. Hunt, governor; J. C. Callaghan, State auditor; Chas. R. Osburn, citizen member and secretary; Lamar Cobb, State engineer, Phoenix.

County Road Officials.—County board of supervisors, county road superintendents. Office county road superintendent, abolished to take effect January 1, 1915, thereafter county engineers will be appointed by board of supervisors.

Arkansas

State Highway Commission. Five members, of which the commissioner of State lands, highways and improvements, is chairman, appoints a State highway engineer The present State highway engineer is H. R. Carter, at Little Rock.

County judges elected in September of even years, and who take office November 1, have control of highways, but there are many special laws affecting localities.

California

State Highway Commission, Sacramento.—Charles D. Blaney, Saratoga, chairman, Newell D. Darlington, Los Angeles, Chas. F. Stern, Eureka.

Austin B. Fletcher, formerly the secretary and chief executive officer of the Massachusetts highway commission, is the highway engineer and executive officer of the commission. Wilson R. Ellis of Berkeley is secretary of the commission.

The headquarters office is at Sacramento and the division offices are maintained in San Francisco, Los Angeles, Dunsmuir, Fresno, San Luis Obispo and Willits.

County supervisors, of whom there are five in each county, elected for a term of four years in November of even years, have authority over roads. The county surveyor is elected. Several counties have county highway commissions and county engineers.

Colorado

State highway commissioner Mr. T. J. Ehrhart, of Denver, Colorado. There is an advisory board of five members, composed at this time of J. M. Kuykendall, chairman, Denver; Leonard E. Curtis, V. chairman, Colorado Springs; Chas. R. McLain, member, Canon City; L. Boyd Walbridge, member, Meeker; C. E. Herr, member, Durango and secretary and engineer, J. E. Maloney, Littleton; stenographer, A. A. Ross, Denver.

County commissioners of whom there are three in each county, elected by the people in November of even years for four years, have jurisdiction over local roads.

General road overseer for county may be appointed by county commissioners or district overseers for districts.

Connecticut

State Highway Commissioner.—Charles J. Bennett, Hartford.

Deputy Highway Commissioner.—Richard L. Saunders, Hartford.

Division Engineers.—R. S. Hulbert, Winsted; E. C. Welden, Willimantic; J. A. McElroy, Middletown; C. A. Campbell, Norwich; G. E. Smith, Milford; O. W. Head, New Haven.

Delaware

New Castle County Levy Court.—E. B. Hollingsworth, Montchanin, term expires December 31 1916, president, for the year 1914; S. J. Burris, Wilmington, term expires December 31, 1916; W. T. Purks, Wilmington, term expires December 31, 1918, can succeed himself for term of four years; B. A. Groves, Marshallton, term expires December 31, 1918, can succeed himself for a term of four years; M. E. Smith, Rosehill term expires December 31, 1916; T. S. Fouracre, Middletown, term expires December 31, 1918, can succeed himself for a term of four years; W. A. Scott, Townsend, term expires December 31, 1916.

New Castle County State highway commissioner, James Wilson, who is a State official, and has charge of the building of improved roads and is also county engineer.

Kent County Levy Court.—W. Hart Scott, county engineer, Dover.

Sussex County.—M. T. Gum, county engineer, Georgetown.

District of Columbia

Engineer commissioner in charge of all public work, Maj. C. W. Kutz, U. S. A.; surface division is in charge of Capt. W. D. A. Anderson, U. S. A., assistant to the engineer commissioner; engineer of highways, Mr. C. B. Hunt.

Florida

County commissioners of whom there are five in each county, elected in November of even years, for two year terms, have supervision of roads.

Three road commissioners must be appointed annually by the county commissioners for each road district.

A road overseer must be appointed by the road commissioners for each subdivision of road districts.

Where the voters elect to have their road district a special tax road district they elect at the same time three trustees to supervise the road work of the district.

Georgia

Georgia has no State highway department but the geological survey collects and publishes data on roads. Dr. S. W. McCallie is the State Geologist.

State prison commission has authority over convict labor, which is utilized for road improvement. Mr. R. E. Davidson, Atlanta, is the chairman of the commission.

Board of county commissioners three to five members, have jurisdiction of roads and must divide county into road districts. Three road commissioners are appointed for each road district and these appoint overseers.

Idaho

State Highway Engineer.—Edw. S. Smith, Boise.

State Highway Commission as created by the 1913 legislature consists of five members: Theodore Turner, chairman; E. A. Van Sicklen; W. L. Gifford, secretary of state, secretary; F. P. King, State engineer; Dr. C. N. Little, professor of civil engineering, State University.

The three last named are made members ex-officio of the commission by the provisions of the bill creating the same. The two civilian members are appointed by the governor to hold office until the first Monday in January, 1914 and 1915, respectively, a commissioner to be appointed at the expiration of the term of each of the foregoing appointees.

Illinois

State Highway Commission, Springfield.—A. D. Gash, president; Jas. P. Wilson, S. E. Bradt, secretary; W. W. Marr, chief State highway engineer and P. C. McArdle, assistant State highway engineer.

In counties having township organization three township highway commissioners elected by the people have jurisdiction, one of whom is elected in April of each year, and may employ general superintendent, overseers, et al. In counties not having township organization, county boards of commissioners, elected by the people, divide county into road districts, in each of which three highway commissioners and one clerk are elected, and these may appoint general superintendent, overseers, et al.

The new law provides also for the election of one commissioner in each township provided the voters petition for it. It also provides that in counties under township organization the supervisor becomes the treasurer of the road and bridge fund of the township; and in counties under the county commissioner system, a district clerk must be elected who should serve as treasurer of the road and bridge fund of the road district. In the latter cases, the one commissioner serves for a term of three years, after which a change may be made back to the three commissioner system in the same manner as the change was made in the first place.

County superintendents are appointed with jurisdiction over construction, repair and maintenance of all highways and bridges in counties and towns. They are by law deputies of the State highway engineer. They have veto power over expenditures in excess of $200 in all township and road districts.

Indiana

Three county commissioners in each county, one commissioner elected in November of each year, have supervision over roads. They are also ex-officio a board of directors for all free gravel, macadam and turn pike roads and shall appoint a county highway superintendent for 2 years. They also appoint superintendents of construction for gravel roads built by assessment of contiguous property.

Boards of township trustees elected in November every four years divide the township into road districts and a supervisor is elected every odd year in December in each road district.

The county highway superintendent shall appoint assistant superintendents not to exceed four for each 100 miles of road. The county highway superintendent shall have general supervision of the maintenance and repair of all county highways, bridges and culverts.

Iowa

State Highway Commission composed of three members, two of whom shall be of opposite political parties appointed for a term of four years by the governor of the State, and the third member to be the dean of engineering department of the Iowa State College of Agriculture and Mechanic Arts.

Highway Engineer, T. H. MacDonald, Ames, employed by the highway commission.

County Board of Supervisors, elected by the people, of from three to seven members, who are in control of the county road system and all bridge building on both county and township road systems.

County Engineer, an employee of the supervisors, who is in active charge of all road work on the county system and all bridge and culvert work on both county and township systems. The engineer is employed by the supervisors but works under the direction of the highway commission and his term of office may be terminated at will by the commission.

Township Trustees, three for each township, elected by the people and in control of township road work.

Road superintendent, an employee of the township trustees, who is in charge of all dragging and all road work on the township road system.

Kansas

The State engineer is appointed by the board of administration of the State Agricultural College, Manhattan. W. S. Gearhart, Manhattan, is State engineer.

Board of three county commissioners elected in November of odd years, for a term of four years, has jurisdiction over State and county roads.

County engineer appointed by commissioner in June of odd years, has general charge under direction of county commissioners.

Township trustee, clerk and treasurer constitute township highway board having charge of township roads and mail routes. Their term is two years.

One or more overseers are appointed by the township board to superintend the township and mail route road work.

Kentucky

State commissioner of public roads, Robert C. Terrell, Frankfort.

County fiscal court, consisting of county judge and five to eight justices of the peace, elected by people, have jurisdiction over all roads. County judges elected for four years.

A county road engineer is appointed by said court.

A district road overseer is appointed for each road district.

Louisiana

The board of State engineers of Louisiana, of which the highway department is a branch, is composed of the following members; F. M. Kerr, chief state engineer, Gervais Lombard, J. W. Monget, Marshall Robertson, John Klorer.

The officers of the highway department of the board of State engineers, are: F. M. Kerr, chief State engineer, and president of the board of state engineers; W. E. Atkinson, State highway engineer; Chas. F. Wood, secretary, New Orleans.

Police juries have control of roads in each parish. Last election April, 1912, for four years.

Maine

State Highway Commission, Augusta.—Lyman H. Nelson, chairman; Philip J. Deering; William M. Ayer; Paul D. Sargent, chief engineer.

Maryland

Gov. P. L. Goldsborough; chairman, O. E. Weller; W. B. Miller, Andrew Ramsay, Thomas Parran, John M. Perry, J. Frank Smith; assistant to chairman, F. H. Zouck; chief engineer, Henry G. Shirley; secretary, William L. Marcy; counsel, Leon E. Greenbaum.

Board of county commissioners have full authority over local roads and may appoint supervisors, engineers, etc.

Massachusetts

State Highway Commission, Boston.—William D. Sohier, chairman; Frank D. Kemp, James W. Synan, Frank L. Bieler, secretary; Arthur W. Dean, chief engineer.

County commissioner may, upon petition lay out new roads or make specific improvements, and may direct towns and cities to make such improvements.

Selectmen, three to each town, elected in March each year, have purchasing power, except in cities.

A road superintendent or highway surveyor is usually elected at each annual town meeting. In some towns he is appointed by the selectmen.

Michigan

Frank F. Rogers, *State highway commissioner*, Lansing; Leroy C. Smith, deputy highway commissioner.

In counties having township system, one township commissioner, elected annually, has control.

In counties having district system control vests in a board of district supervisors, one from each township in the district, elected for a term of two years.

In counties having county system the Board of three County Commissioners is in charge. One commissioner is elected every two years, to hold office six years. All elections held the first Monday in April.

Minnesota

State Highway Commission, St. Paul.—C. M. Babcock, chairman; F. S. Bell, Clarence I. McNair. George W. Cooley, State engineer and secretary of commission; John H. Mullen, chief road deputy; Carl D. Nagel, chief Bridge deputy; S. C. Notestein, chief clerk.

Board of five county commissioners elected in November for four year term has control of county funds subject to supervision of State highway commission. Next election 1916. Three town supervisors in each town conduct work under highway commissioners.

Mississippi

Each county must be divided into five districts, each of which elects a supervisor, the five constituting a county board of supervisors, who have full authority over roads. They are elected for a term of four years and take office in January. The next change occurs in 1916. The board of supervisors appoint three road commissioners to manage the roads of a supervisor district when the district so petitions for a term of four years, subject to supervisors control.

Missouri

Highway Department of State Board of Agriculture, Jefferson City.—Frank W. Buffum, State highway commissioner; W. S. Hawkins, deputy commissioner.

Missouri has two systems of local road administration. In ninety-two counties the county court, consisting of a chairman, elected for a term of four years, and two associates, elected for two years has control, and appoints a county engineer annually except in counties which have suspended the act relating to county engineers; divides the county into districts and appoints overseers who report to county engineer.

In the twenty-two township counties the roads in each township are under the control of a township board of three members, elected every two years, who divide the township into road districts and appoint overseers.

Next election for chairman county court, November, 1914. Two associate members county court elected November of even years. County engineers appointed in January of even years.

Montana

State Highway Commission, A. W. Mahon, Helena, State engineer, chairman; Geo. R. Metlen, secretary; Prof. L. D. Conklin, Bozeman.

County commissioners, three to each county, have supervision of roads. One commissioner is elected in November of even years and holds office for six years. The commissioners appoint supervisors and a county surveyor.

Nebraska

State engineer, Donald D. Price, Lincoln; C. P. Mason, assistant State engineer, Lincoln.

County commissioners three to each county, elected in November of even years, have control where township organization does not exist. They divide county into districts, in each of which an overseer is elected by the people.

The county commissioners appoint a county highway commissioner in January of each year, who must be experienced road builder.

In counties under township organization, the county commissioners divide the county into seven supervisor districts, in each of which a supervisor is elected by the people. The town boards in each town have supervision over the roads, subject to the general control of the board of supervisors or the county commissioners. The town board divides the town into road districts and appoints an overseer for each district.

Nevada

State engineer, W. M. Kearney, Carson City.

County commissioners elected by the people have supervision over the roads. They appoint a county surveyor and divide the county into road districts, in each of which they appoint a road overseer.

New Hampshire

State Highway Department, Concord.—S. Percy Hooker, State superintendent of highways.

Assistant Engineers.—F. W. Brown, Concord; F. E. Everett, Elkins; W. A. Grover, Dover; H. L. Smith, Lakeport; C. M. Brooks, Keene; O. M. James, Northwood Narrows; C. H. Chandler, Concord; C. P. Riford, Concord; F. H. Colburn, Concord.

New Jersey

State Department of Public Roads, Trenton.—Edwin A. Stevens, State road commissioner; Robert A. Meeker, State highway engineer.

Division Engineers in Charge of Roads.—E. M. Vail, E. E. Reed, Roy Mullins.

Division Engineer in Charge of Bridges.—Lloyd McEntire.

The State department of public roads is under the direct control and supervision of the commissioner.

In addition thereto a State highway commission, composed of the governor, president of the senate, speaker of the house, State treasurer and the commissioner of public roads, has charge of the design and location of a system of State highways, connecting the county seats and principal cities of the State with each other and with the main outlets to the State boundaries.

The county boards of Chosen freeholders, composed of one member from each township and minor municipality and a varying number from the several cities, are elected in November of each year. These freeholders have charge of the county roads and bridges in their several counties. They appoint a county engineer for a term of five years; they also appoint a county supervisor of roads for the same period, whose duty it is to take charge of all county repair work.

New Mexico

State Highway Commission, Santa Fe.—Wm. C. McDonald, governor; Robert P. Ervien, land commissioner; James A. French, State engineer.

The county commissioners are elected in November at the regular election day and the next election will be in 1916 and will be for a term of two years. On account of adopting a new constitution and becoming a State, the present commissioners were elected in November, 1911, and will hold for five years. The commissioners take office the first of January following election.

The county road work is under the supervision of a county road board, who are appointed by the State highway commission for term of three years and subject to removal by them for cause. This law went into effect on September 10, 1912. The various boards were not appointed until November. They have all the authority relating to roads formerly delegated to the county commissioners, except that of taxation.

New York

State Commissioner of Highways, Edwin A. Duffy; first deputy commissioner, H. Ellinge Breed; second deputy commissioner, Fred W. Sarr; third deputy commissioner, Benjamin J. Rice; auditor Sephrine D. Gilbert; secretary Royal K. Fuller; assistant secretary Frank R. Pennock, Albany.

Town highways are under town superintendents elected in November of even years. The superintendents are under supervision of a county superintendent.

North Carolina

Geological and Economic Survey, Chapel Hill.—Joseph Hyde Pratt, State geologist and engineer. Highway engineers: T. F. Hickerson, W. S. Fallis, D. T. Brown, R. P. Coble.

In most cases the county commissioners, averaging three in a county, and elected in November of even years, have control of roads. It is, however, becoming increasingly prevalent to have special road commissioners either as county or township commissions to take charge of road work. In many counties the highway division of the survey has been able to place highway engineers, who, while they are paid by the counties, are considered as State highway engineers and carry on the work in accordance with the suggestions and regulations of the State survey.

North Dakota

State Engineer.—Jay W. Bliss, Bismarck.

Highway Commission.—Gov. L. B. Hann, Bismarck; C. A. Grow, Minot; Jay W. Bliss, Bismarck.

County Commissioners of whom there are three in some counties and five in others, elected by the people, may appoint a county superintendent of highways in January of even years. The county superintendent has charge of the construction and maintenance of roads, and appoints deputies.

County Superintendents.—Griggs County, Martin A. Ueland, Cooperstown; Dickey County, Sol Hunter, Oakes; Stark County, W. R. Veigel, Dickinson; Billings County, Thor G. Plomasen, Beach; McKenzie County, Chas. R. Martin, Schafer.

Ohio

State Highway Department, Columbus.—James R. Marker, State highway commissioner; deputies: Clifford Shoemaker, construction; John R. Chamberlin, bridges; A. H. Hinkle, maintenance. Chief clerk, J. H. Tilton; division engineers, D. W. Seitz, Nicholas Koehler, Harwood Lersch, John Laylin, Tracy Brundle, H. D. Brunning, T. T. Richards, Ray Tanner, P. K. Sheidler, J. R. Burkey, J. W. Graham, W. G. Smith.

County commissioners three to each county, elected in November of even years, have charge of county roads. County surveyor, elected at the same time, has direction of actual work.

Township trustees, three to a township, elected in November of odd years, have charge of township work.

Oklahoma

State Department of Highways, Oklahoma City.—Sidney Suggs, commissioner; Clark Hudson, assistant commissioner; W. R. Goit, chief engineer; Walter S. Gilbert, secretary.

Township board of trustees elected by the people has charge of roads in most of the counties. They appoint a road supervisor for each road district into which the township is divided.

County commissioners elected by the people may appoint a county engineer.

In twenty-seven counties the township was abolished as a road unit and authority was given the county.

Oregon

State Highway Engineer, Henry L. Bowlby, Salem.

County courts consisting of a county judge and two county commissioners elected by the people have charge of roads.

Road masters and road district supervisors appointed every January have charge of work under direction of county court.

Pennsylvania

State Highway Department, Harrisburg.—E. M. Bigelow, State highway commissioner; J. W. Hunter, first deputy commissioner; E. A. Jones, second deputy commissioner; S. D. Foster, chief engineer; W. R. Main, C.P.A., auditor; Howard W. Fry, chief clerk.

County commissioners, three to each county, elected for four year terms have charge of county work. Township supervisors, three to each township, have charge of township work. One member is elected in February every two years and holds office six years.

Rhode Island

State Board of Public Roads, Providence.—Frank Cole, William C. Peckham, John F. Richmond, Benj. F. Robinson and Abram E. Atwood, members of board; Irving W. Patterson, engineer; Peter J. Lannon, clerk.

The governor appoints one member of the board from each county for a term of five years, one vacancy occurring every year.

Each town through its officials, known as road commissioners or surveyors, looks after its road affairs. These officials are in some cases elected, in others appointed, by town council.

South Carolina

County commissioners elected in November of even years have charge of roads. In most of the counties a county supervisor of roads is elected at the same time. In other counties the commissioners appoint a county engineer.

E. J. Watson, commissioner of agriculture, commerce and industries, Columbia.

South Dakota

State Highway Commission.—E. C. Issenhuth, chairman, Redfield, N. O. Monserud, Sioux Falls; B. M. Wood, Rapid City;

In some of the counties the roads are under supervision of county commissioners, of whom there are five, elected by the people. In other counties township boards of three supervisors have charge of roads within the township.

Tennessee

No State highway department.

Judges of county courts have supervision of roads. In January of odd years the county court divides the county into road districts and appoints a road commissioner for each district. A board of turnpike commissioners, selected every four years by county court and consisting of three members, looks after toll roads. The district road commissioner appoints an overseer for each section of road in January each year. Many counties have special laws.

County judges have control of roads, and preside over commissioners. Court of four members besides the judge. The members are elected in November of even years for three-year terms. Districts or precincts may be formed in counties in which case trustees elected at same election have charge.

Texas

No State highway department.

The unit of administration is the county. In most instances the county judge has charge of road matters but in some counties the authority rests with a board of county commissioners.

Utah

State Highway Commission, Salt Lake City.—Wm. Spry, chairman; Richard R. Lyman, vice-chairman; Jesse D. Jewkes, Wm. Peterson; E. R. Morgan, State road engineer and secretary.

County commissioners, of whom there are three in each county, elected in November of even years, have supervision of roads. They appoint a county road commissioner who has full charge of the road work.

Vermont

State highway commissioner.—Stoddard B. Bates.

The State highway commissioner appoints a supervisor of roads in each county as his representative.

In March each year one selectman, of which there are three, and a road commissioner are elected in each town, the former to have charge of purchases and location and changes in roads, and the latter to have charge of maintenance.

Virginia

State Highway Commission, Richmond.—G. P. Coleman, State highway commissioner; Wm. M. Thornton, dean, engineering department, University of Virginia; Col. T. A. Jones, professor of civil engineering, Virginia Military Institute; R. B. H. Begg, dean engineering department, Virginia Polytechnic Institute; C. B. Scott, assistant commissioner; B. Atkins, clerk.

Engineers.—D. McDonald, assistant; W. F. Cocke, assistant; F. D. Henley, assistant; A. H. Pettigrew, assistant. S. L. von Greuninger, assistant; C. D. Snead, bridge engineer.

County boards of supervisors, consisting of three or more members elected in January, to serve four years, have control of roads. The next election will be held in 1916. The board may appoint a county road superintendent in January of even years. They may also appoint a superintendent for each magisterial district. There are many special road laws relating to specific counties.

Washington

State Highway Board, Olympia.—Governor Ernest Lister, chairman; Wm. R. Roy, State highway commissioner, secretary;

Edward Meath, State treasurer; C. W. Clausen, State auditor, and Judge M. M. Godman of the public service commission.

Three county commissioners, elected in November of even years, two every two years and one every four years, the long term alternating, have control of roads, except where township system prevails. They divide county into districts and appoint a supervisor for each to serve at their discretion.

A county engineer is elected in November of even years.

The citizens of any county may by majority vote adopt township organization.

West Virginia

State Road Bureau.—A. D. Williams, chairman and chief road engineer, Morgantown; the director of the State experiment station ex-officio and two members appointed by the governor. Personnel E. D. Sanderson, Morgantown; Geo. B. Chorpening, Clarksburg, J. W. Lynch, Union.

Three county commissioners, elected for six years, one every two years in November at regular elections, have control of roads. The county commissioners may appoint a county engineer in October of odd years.

Wisconsin

Wisconsin Highway Commission, Madison.—J. A. Hazelwood, chairman, Jefferson; W. O. Hotchkiss, State geologist, Madison (ex-officio); F. E. Turneaure, Madison (ex-officio); John S. Owen, Eau Claire; J. H. Van Doren, Birnamwood.

A. R. Hirst, State highway engineer; M. W. Torkelson, bridge engineer.

A county commissioner elected by the county board has charge of the State and road and bridge work in each county, subject to the general supervision and inspection of the State highway commission.

A town chairman of town board, elected in April each year, has charge of town roads.

Wyoming

A. J. Parshall, Cheyenne, *State engineer*; Henry G. Watson, deputy engineer, J. B. True, Asst. Engineer.

There are three county commissioners in each county, two being elected in November of the even years, one for a term of two years and one for a term of four years. These commissioners have charge of the county roads. The Counties are divided into road districts, in each of which a supervisor is elected. The supervisor performs his duties under the direction of the County Commissioners.

State Geologists

Alabama Geological Survey, Dr. Eugene A. Smith, State geologist, University, Alabama.

Arizona Geological Survey, C. F. Tolman, State geologist, Tucson, Arizona.

Arkansas Geological Survey, N. F. Drake, University of Arkansas, Fayetteville, Arkansas.

California State Mining Bureau, F. McN. Hamilton, State mineralogist, San Francisco, California.

Colorado Geological Survey, Prof. R. D. George, Boulder, Colorado.

Connecticut Geological and Natural History Survey, Prof. William North Rice, superintendent, Middletown, Connecticut.

Florida Geological Survey, Dr. E. H. Sellards, State geologist, Tallahassee, Florida.

Georgia Geological Survey, Dr. S. W. McCallie, State geologist, Atlanta, Georgia.

Illinois State Geological Survey, F. W. DeWolf, director, Urbana, Illinois.

Indiana Department of Geology and Natural Resources, Edward Barrett, State geologist, Indianapolis, Indiana.

Iowa Geological Survey, George F. Kay, State geologist, Iowa City, Iowa.

Kansas State Geological Survey, Prof. Erasmus Haworth, State geologist, University of Kansas, Lawrence, Kansas.

Kentucky Geological Survey, J. B. Hoeing, director, Frankfort, Kentucky.

Louisiana Soil and Geological Survey. F. V. Emerson, Baton Rouge.

Maine State Survey and Water Storage Commission, C. C. Babb, Chief Engineer, Augusta.

Maryland Geological Survey, Prof. William B. Clark, State geologist, Johns Hopkins University, Baltimore, Md.

Michigan Geological Survey, Roland C. Allen, director, 503 Hollister Block, Lansing, Michigan.

Minnesota Geological Survey, William H. Emmons, State geologist, University of Minnesota, Minneapolis, Minnesota.

Mississippi Geological Survey, Prof. E. N. Lowe, State geologist, Jackson, Mississippi.

Missouri Bureau of Geology and Mines, Prof. H. A. Buehler, director, Rolla, Missouri.

Nebraska Geological Survey, Prof. E. H. Barbour, State geologist, University of Nebraska, Lincoln, Nebraska.

New Jersey Geological Survey, Dr. H. B. Kummel, State geologist, Trenton, New Jersey.

New Mexico, University of New Mexico, Prof. Charles T. Kirk, State geologist, Albuquerque, New Mexico.

New York State Education Department, Sciences Division, Dr. John M. Clarke, Director and State geologist, State Museum, Albany, New York.

North Carolina Geological and Economic Survey, Dr. Joseph Hyde Pratt, State geologist, Chapel Hill, North Carolina.

North Dakota Geological Survey, R. C. Douegline, director, Grand Forks, North Dakota.

Ohio Geological Survey, Prof. John A. Bownocker, State geologist, Columbus, Ohio.

Oklahoma Geological Survey, C. W. Shannon, director, Norman, Oklahoma.

Oregon, H. M. Parks, State geologist State Bureau of Mines and Geology,

Pennsylvania Geological and Topographical Commission, Prof. Richard R. Rice, State geologist, Beaver, Pennsylvania.

Rhode Island Natural Resources Survey, Prof. Charles W. Brown, superintendent, Providence, Rhode Island.

South Dakota Department of Geology, University of South Dakota. Prof. E. C. Perisho, State geologist, Vermilion, South Dakota.

Tennessee Geological Survey, Prof. A. H. Purdue, State geologist, Capitol Annex, Nashville, Tennessee.

Texas Bureau of Economic Geology and Technology, Dr. Wm. B. Phillips, director, Austin, Texas.

Utah, University of Utah, Dr. J. Fred Pack, Professor of Geology, Salt Lake City, Utah.

Vermont Geological Survey, Prof. George H. Perkins, State geologist, Burlington, Vermont.

Virginia Geological Survey, Dr. Thos. L. Watson, director, Charlottesville, Virginia.

Washington Geological Survey, Prof. Henry Landes, State geologist, University Station, Seattle, Washington.

West Virginia Geological Survey, Prof. I. C. White, State geologist, Morgantown, West Virginia.

Wisconsin State Geological and Natural History Survey, Dr. E. A. Birge, director and superintendent, W. O. Hotchkiss, State geologist, Madison, Wisconsin.

Wyoming Geological Survey, L. W. Trumbull, State geologist, Cheyenne, Wyoming.

STATE AND U. S. PROGRESS REPORTS

United States Office of Public Roads

Among the most important projects carried on by the office at the present time may be mentioned the following:

Object-lesson roads; county model systems; advice and inspection; superintendence of county roads; road surveys; instruction of students in highway engineering; forest reserves; routine chemical testing of dust preventives and road binders; microscopic examination and classification of road-building rocks; research upon properties of dust preventives and road binders; standardization of methods of testing bituminous road materials; experimental bituminous road construction and maintenance; investigations of concrete; non-bituminous road materials investigations; standardization of tests of non-bituminous road materials; instrument making and repairing; field experiments; traction tests; post roads; general statistical and research investigations; experimental maintenance; economic study of highway systems; traffic census; lectures and demonstrations of road and bridge models; State index including studies of road legislation and administration; investigation of systems of road management; and a study of the use of convict labor on road work.

Since the office was established, 502 object-lesson and experimental roads have been constructed, illustrating various methods for the purpose of instructing local road builders, stimulating sentiment for road improvement, and introducing adequate types and correct methods of road construction. The total number of square yards of road built under this project from July 1, 1905, to July 1, 1914, amounted to 4,689,221.

From 1902 to July 1, 1914, 8426 samples of road material had been tested in the physical and chemical laboratories.

The office had issued up to July 1, 1914, 211 publications, including bulletins, circulars, farmers' bulletins, and annual reports.

The photographic files of the office contained on July 1, 1914, 11,146 negatives and 7175 lantern slides, about two-thirds of which were colored.

The employees of the office on March 1, 1915, numbered 274, of which 125 were collaborators.

An excellent library is maintained which now comprises approximately 9000 volumes.

The office sends its engineers and experts to give lectures and addresses and to confer with State and local officials on all phases of the road subject. Testing and research laboratories are maintained for the purpose of determining the suitability and relative value of various materials for road building. A great deal of experimental work is conducted with bituminous and other binders, concrete and various special materials and methods.

During the last fiscal year, which ended June 30, 1914, there were built 32 object-lesson roads and one experimental road. Blue prints of typical plans for I-beam bridges were furnished to the extent of about 1100 and 28 special designs of bridge plans were furnished in 7 States. Systems of roads were devised for 17 counties. An engineer from the office was assigned to superintend the county roads in 3 counties. One hundred and four assignments were made in 25 States for special inspection and advice with local road officials. Six surveys of roads were made in 5 States. Instruction in highway engineering was given to 9 young men appointed to the position of civil engineer student. Road maintenance work was conducted and is still in progress in the States of Maryland and Virginia, and on the Washington-Atlanta highway through the States of Virginia, North Carolina, South Carolina, and Georgia. Three hundred and thirty-one lectures and addresses were delivered in 46 States, exhibits of road models were made at 17 road conventions or State fairs or like gatherings, and 932 samples of road-building materials were tested in the physical and chemical laboratories.

In order to secure the engineering and expert advice or supervision from the Office of Public Roads an application should be made to the director, by the local authorities having jurisdiction over the road sought to be improved. If it is desired that road materials be tested in the laboratories of the office, application should be made to the director for shipping instructions and blank forms for description of the materials. The assistance given by the office is free to local communities and citizens of the United States where the object sought is of public benefit. The publications of the office may be obtained upon request. The office occupies the entire building at Fourteenth and B Streets, S. W., Washington, D. C.

L. W. Page,
Director.

Alabama

Aid given by State on roads	$96,865.67
Aid given by State on bridges	19,984.67
Total aid given by the State	$116,850.34
Amount spent on roads by counties	$2,003,146.00
Amount spent on bridges by counties	529,638.00
Amount spent on roads by State and counties jointly	256,795.41
Amount spent on bridges by State and counties jointly	44,168.26
Total by State and counties on roads and bridges	$2,833,747.67

Number of miles of road built March 1, 1912, to April 1, 1913

	Graded	*Topsoil*	*Gravel*	*Chert*	*Macadam*
By State aid	31.81	44.72	24.02	21.53	7.0
By counties	531.70	170.00	153.30	101.75	44.75
Totals	563.51	214.72	177.32	123.38	51.75

Total number of miles built by State aid and counties	1,130.58
Total number miles improved March 1, 1913	4,641.81
Total number of miles improved road in Alabama April 1, 1914	5,772.39
Number of miles of road in Alabama	49,639.00
Percentage of improved roads in Alabama	11.63%
Number of counties that had constructed roads previous to 1911	30
Number of counties that are now constructing roads	60
Number of miles of improved road in Alabama March 1, 1911	3,780.00
Number of miles of improved road in Alabama March 1, 1912.	4,641.81
Number of miles of improved road in Alabama April 1, 1914	5,772.39

From April 1, 1914, to January 1, 1915, the following mileage of roads were constructed: graded, 53.41; sand clay, 63.14; gravel, 22.05; chert, 7.00; macadam, 7.44. One hundred and forty-four lineal feet of concrete and 60 lineal feet of steel and concrete bridges were constructed during this period.

Total expenditures from April 1, 1914 to January 1, 1915, by State and counties were as follows: On roads $268,318.96; on bridges, $4,281.86, making a total of $272,600.82.

The average cost per mile of these roads was $1753.26.

W. S. KELLER,
State Highway Engineer.

Arizona

During the fiscal year July 1, 1913, to June 30, 1914, there were expended under the direction of this department and for the purpose shown the following amounts:

Bridges	$54,736.46
Highways	261,005.07
Maintenance	14,669.52
Equipment	11,823.62
Administrative	18,161.31
Total	$360,335.98

In addition to expenditures shown above complete equipment for three prison labor camps was purchased at an expense aggregating $45,000.

With these expenditures there were constructed: 1 142-foot Luten Arch; 1 192-foot through girder; 1 Triple arch 47 feet in length.

The 11 span arch ribbed bridge 1508 feet in length near Tempe, begun in previous fiscal year, was completed. Convict labor was used throughout construction; 10.19 miles of highway constructed, including 3 miles of heavy mountain construction; 11 reinforced concrete culverts from 8 to 30-foot span; 38 concrete boxes; 71 corrugated metal culverts and 3 concrete pavings in washes put in; 3.265 miles road constructed and surfaced with slag; 10 miles recrowned, prison labor used throughout.

Under contract the following were completed: 6.265 miles road graded and surfaced; 77 miles road graded; 9 reinforced concrete structures from 13 to 60 feet built; 3110 feet corrugated metal culverts installed.

Data as to construction and maintenance work under direction of county officials not available. There was expended however under county jurisdiction approximately $550,000.

E. P. Adams,
Chief clerk.

Arkansas

According to a chart prepared by the State highway department, there are more than 30,000 miles of public road in the State, as follows: 12,000 miles of unimproved earth; 13,000 miles of improved earth; 2500 miles of sand clay; 2200 miles of gravel; 265 miles of macadam; 655 miles of other types.

It is anticipated that approximately 100 miles of gravel and 70 miles of macadam road will be constructed during the coming year.

Approximately $1,163,000 derived from the 3 mill tax was expended during 1914.

A resolution has passed the 1915 legislature permitting the people to vote upon an amendment to the constitution authorizing bond issues by counties.

From chart by H. R. Carter,
State Highway Engineer.

California

The State highways act providing the sum of $18,000,000 for construction of the system of State highways, distinct from the State roads built under legislative appropriations, outlines in general terms the scope of work, the location of the routes, places the jurisdiction over the proposed State highways in the department of engineering and provides for the bond issue, for a State highway fund, and State highway sinking fund.

The California highway commission, organized to carry out the mandates of the State highways act, has provided a working system similar to that of a modern business corporation, in which the three highway commissioners act as a board of directors, and the highway engineer who is the executive officer of the commission corresponds to the general manager of a business corporation. Under the highway engineer are the several departments of the work: engineering and operating department; legal department (in right of way matters); purchasing department; accounting department; disbursing department; and publication and statistical department. The chiefs of the several departments report directly to the highway engineer. Funds became available so that State highway work was initiated May 21, 1912, and at the close of 1914 the advisory board of the department of engineering had adopted sections of State highway aggregating 1164 miles in length. Including these, surveys have been made on the State highway aggregating 2150 miles. Contracts have been let including certain day labor totaling 987 miles. Of this 987 miles 650.1 miles are cement concrete construction, with a thin bituminous top; 19.1 miles are of cement concrete with a thick bituminous top; 24.4 miles are macadam, penetration method; 7.6 miles are macadam with thin bituminous carpet; 16.5 miles are macadam with thick bituminous top; 3.1 miles timber and concrete trestle; and 266 miles are graded roads.

A. B. Fletcher,
Highway Engineer.

Colorado

The total length of roads in the State is estimated to be 31,000 miles, of which 500 miles are estimated to be hard surfaced. No roads have been completed entirely at the expense of the State, but it is estimated that 5000 miles have been improved partly at the expense of the State and partly at the expense of local sub-divisions. An additional 600 miles are in course of improvement jointly by the State and sub-divisions. No roads are maintained at the expense of the State but there are approximately 5400 miles maintained under the direction of the county commissioners for which the State pays a portion of the cost. There were 500 miles of road graded and drained and about 150 miles of road surfaced with gravel, shale, sand or clay, under the direction of the State highway commission during the calendar year 1914. The total expenditure of State funds on State roads during 1914 was $372,000, and of county funds on these roads approximately $300,000 making a total expenditure on State road system for the year of approximately $672,000.

The last legislature amended the highway act by providing for one State highway commissioner and an advisory board of five members, who were appointed and took office in March, 1913. The State highway commissioner receives a salary of $3000 and the secretary-engineer a salary of $2100. No bonds were issued in the State during the year but the direct tax has been increased in most of the counties and at the election of November, 1914, the people voted a one-half mill levy for the State amounting to $600,000 per year which will be available in 1916.

Five convict camps of approximately 50 men each were worked on the roads in different portions of the State during the year.

The grading and ditching on the 500 miles of State road during 1914 averaged about $430 per mile. About 80 bridges were built, of steel and reinforced concrete, at an average cost of $1000 each; 400 culverts were placed at an average cost of about $50 each. The 150 miles of road surfaced with gravel, shale, sand or clay averaged about $500 per mile. The expenditure on county roads of the State amounted to about $300,000 on some 20,000 miles of road. Work has been in progress in every county in the State and the main passes have been rendered so as to permit travel with comfort, and by the end of the coming season it will be possible to travel by wagon or automobile to any section of the State.

J. E. Maloney,
Secretary-Engineer.

Connecticut

The present state highway commissioner took office February 26, 1913. From the date to October 1, 1914, the total amount of state funds expended was $6,724,608.44. This outlay was classified as follows:

Construction	$4,805,825.25
Maintenance	1,717,671.94
General Engineering	171,524.75
Administration	23,450.35
Commissioner's automobile	4,697.15
Commissioner's traveling	1,439.00
Total	$6,724,608.44

During that period $2,945,408.76 was expended on state roads constructed at expense of the state aggregating 226.66 miles improved and 60.39 miles reconstructed. A total of $1,860,416.49 was expended from state and local funds on construction of roads paid for partly by State and partly by towns. The mileage thus constructed amounted to 105.57 miles and 5.32 miles reconstructed. The grand total of roads constructed and reconstructed during this period was 397.94 miles. The total of all state roads improved as of October 1, 1914, was 1,281.68 miles. (From report of state highway commissioner to the U. S. Office of Public Roads.)

Delaware

The good roads work in this State was first taken up under an act of the general assembly approved April 14, 1903, which provided for the appointment of a commission of three, one from each county in the State, which had charge of all improved roads to be built in the State under State aid.

The act provided that the State would pay one-half the cost of building roads in each of the three counties if the cost per year to the State did not exceed $10,000 for each county. The act also required that public meetings be held for the promotion of the good roads sentiment.

The commissioners appointed under this act were Cornelius J. Horrigan, chairman; Walter J. Harrington, secretary, and John Barr.

Under this law there were built 7.98 miles in New Castle County, and 0.907 mile in Sussex County.

The above mentioned law was repealed at the session of the general assembly held in 1905 and the law under which we are now working in New Castle County was approved March 3, 1905. This law created the office of New Castle County State highway commissioner, applied to New Castle County only, and provided for State aid to the extent of $10,000 per year. The highway commissioner however has charge of the building of all improved roads in the county, whether State money is used or not and all plans, specifications and contracts must be approved by him before they become effective and no bills can be paid without his approval; in other words the highway commissioner and the levy court are both responsible for the proper building of the roads and the payment of all bills relating thereto. The highway commissioner has no jurisdiction over the roads after they are finally accepted from the contractor.

Under this law there have been built 176.70 miles, all of which is water bound macadam, with the exception of about 3.13 miles of a bituminous surface, penetration method, and 0.94 miles of amiesite road. The county has also taken over 11.32 miles of turnpikes, making a total of 188.02 miles of stone roads under its care. This year $50,000 was set aside from our taxes for the maintenance of these roads, and two more steam rollers with their accompanying sprinklers were bought, making five rollers, with their water barrel sprinklers, etc., in the seven rural districts. Within the next year we shall have completed some 15 miles more of improved roads, making over 180 miles of improved road. A bond issue of $100,000 was specially set aside to fill in the gaps or broken pieces of road, so as to make at least one continuous improved road from the northern boundary of New Castle County, or Pennsylvania line, to the southern boundary, or Kent County line. This has been done and we now have two improved roads, one on the east and one on the west side of the county running the full length of the county. We have now eight good stone roads, radiating from Wilmington to the Pennsylvania State line and have hopes that in the near future that State will meet us at some of them. We have also built two to the Maryland State line on routes to Baltimore.

Maryland has met us on the old Newark and Elkton road with a very good improved highway. In our efforts to find some good surface treatment, both durable and economical, we have experimented with several kinds of oils, calcium chloride and a small quantity of glutrin, but as yet are undecided in the matter. Kent and Sussex Counties have no State highway commissioners, but have a road engineer in each, appointed by their respective county bodies, and I understand are beginning some good work.

The expenditures on construction of roads has been about $1,518,850.31, making an average cost of construction of about $8,077.75 per mile. This cost includes the construction of bridges, culverts (mostly concrete) and all other appurtenances necessary in the proper construction of a good road.

The estimated length of all public roads in this county is about 1000 miles, from which it may be seen that nearly 19 per cent of our roads are improved roads.

The general assembly of the year 1913 passed a law empowering the levy court to contract, when advisable, with our county workhouse authorities for the use of the short term prisoners on our county roads. With this law we have done considerable repair work, and built one short stretch of road 625/1000 miles in length at a contract price of $2787.57 and another of $2300. The work so far has been very satisfactory.

James Wilson,
State Highway Commissioner and County Engineer.

District of Columbia

The commissioners forward to congress, through the secretary of treasury, estimates of proposed expenditures for each fiscal year ending June 30. To the extent to which these estimates are approved, inasmuch as the national government owns fully one-half in value of the property in the district, congress appropriates 50 per cent, and a like proportion is paid from the district revenues.

Pavements	*1914 miles*
Asphalt	151.60
Asphalt block	31.36
Granite block	25.58
Cobble	4.12
Vitrified block	1.34
Bituminous concrete	6.16
Cement concrete	1.66
Bituminous macadam	4.36
Waterbound macadam	117.76
Gravel and dirt roads	166.03
Total	509.97

Approved by W. D. A. Anderson
Captain, Corps of Engineers, U. S. A.
Assistant to Engineer Commissioner, D. C.

Florida

Florida has no State highway department and does not grant aid in the form of money and supervision for road work. A number of the individual counties, among which may be mentioned Hillsboro, Duval and Dade have made exceptional progress and it is by no means improbable that the legislation now in session will provide some form of State participation in road work.

Georgia

No State highway department exists and a State report is therefore impracticable. It may be stated, however, that upwards of 5000 State convicts are regularly employed on the public roads of the State under local supervision, resulting in a great increase in the mileage of improved roads, particularly of the sand-clay type.

S. W. McCalhe,
State Geologist.

Idaho

The present State highway department was created by the 1913 legislature and consists of a State highway commission of five members, including ex-officio, the State engineer, secretary of state and the professor of civil engineering of the State university, and two civilian members appointed by the governor. The engineering department is under the direction of a State highway engineer appointed by the commission. The legislature authorized a State bond issue of $200,000 to aid in the construction of proposed State roads on the plan of the State bearing one-third of the cost of construction and the county two-thirds. The location, surveys, estimates, etc., are made at the expense of the State, and the roads are built under the supervision of the State highway engineer under contracts which are let by the State highway commission. After completion all roads of this kind are maintained at the expense of the State.

Fourteen hundred miles of proposed State highways, comprising the main trunk line system designated by the State highway commission, have been surveyed and estimates of cost prepared. Contracts were awarded covering 300 miles of these and construction work started in September, 1914, on 233 miles which is expected to be completed by June 1, 1915. Five hundred and ten miles, including completion of above, are planned for 1915.

The types of roads being built at present are earth, gravel and crushed gravel macadam to standard sections. All bridges and culverts are of permanent type.

The highway commission is authorized to use State convict labor on road construction but none has yet been employed.

Data on the amount of money spent by counties on county road and bridge work during 1914 is not yet available, but in 1913, approximately $1,265,000 was expended from the general road and bridge fund, most of it under the old road overseer system. Various counties have voted road and bridge bond issues amounting in total to about $1,250,000 to January 1, 1915.

Under the State aid plan the State highway bond issue of $200,000 authorized in 1913, would have made available a total expenditure of $600,000, but the awarding of contracts has been seriously handicapped by the inability of the State to market the bonds which draw only 4 per cent interest, and must be sold at par.

EDW. S. SMITH,
State Highway Engineer.

Illinois

Under our State aid system, we now have under contract 97 miles of road, 18.5 miles of which are brick and 78.5 miles concrete. These roads, while all under contract are not yet entirely completed. The amount entirely completed during 1914 being 64 miles. The work in 1915, up until July 1, will consist of expending the remaining portion of the $1,100,000, provided by the last legislature as State aid. Our activities after July 1, will of course, depend entirely upon the action of the legislature at its present session.

During 1914, we constructed experimental or township road work as follows: concrete, 3.5 miles; waterbound macadam, 22.7 miles; bituminous macadam, 3.2 miles; re-surfacing old macadam, 3.6 miles.

The outlook for 1915 along this line is that there will be constructed probably in the neighborhood of 40 miles of road. At the election last November, Cook County, Illinois, voted favorably upon the issuance of bonds to the amount of $2,000,000 for rural road construction and Vermilion County, Illinois, at the same time, voted $1,500,000. The expenditure of these sums will probably begin about next April.

W. W. MARR,
Chief State Highway Engineer.

Indiana

No State highway department exists, and no central source of information from which a full report can be obtained. The governor appointed a commission during June, 1914, composed of Addison C. Harris, chairman, Indianapolis; Thomas T. Taggart, French Lick; Leonard F. Clore, LaPorte; William H. O'Brien, Lawrenceburg; Prof. R. L. Sackett, LaFayette; Luke W. Duffey, secretary, Indianapolis, to investigate the roads and road laws of the State. The report of this commission was made a part of the governor's message to the legislature of 1915.

This report recommended the establishment of a State department in an advisory and educational capacity.

STATE STATISTICIAN'S STATEMENT

Number miles gravel roads January 1, 1914	26,364
Number miles unimproved roads January 1, 1914	36,461
Number miles gravel road constructed 1913	1,740
Gravel road repairs, 1913	$2,017,205.37
Bridges and bridge repairs, 1913	2,001,129.32
Road tax worked out, June settlement, 1913	855,469.10

Iowa

The total mileage of all the roads in Iowa outside of incorporated towns and villages, is 104,017. The estimated total mileage of roads, including city pavements, improved by hard surfacing is 500. Included under this heading would be classified all roads that have macadam, concrete, or brick surfacing. At this time there are, to our knowledge, only 7 or 8 miles of concrete roads in this State outside the limits of incorporated cities and towns. The estimated amount of 500 miles does not include probably 500 miles of the roads in the State which have been graveled. This can hardly be called hard surfacing and for this reason has been omitted from this classification.

There is no law in this State which allows the State to bear a portion of the expense for the construction and maintenance of the highways. At present this work is carried on entirely by the townships and the counties. Under the law enacted by the thirty-fifth general assembly of this State all of the roads in the State are under the general supervision of the State highway commission. A division is made in each county into townships and county roads. The county constructs and maintains the entire county road system which is composed of not less than 10 per cent and not more than 15 per cent of the total mileage of the county. These roads included in the county system have been designated as county roads and the township officials have no authority over them. The remainder of the roads in the townships outside of the limits of incorporated cities and towns are under the supervision of the local township officials, namely, the township trustees and road superintendents.

The thirty-fifth general assembly provided a maintenance fund consisting of 8 per cent of the motor vehicle tax for the general expenses of the State highway commission. This is the only expenditure made by the State towards road improvement at this time. Previous to April 9, the date when the new law went into effect, the work of the commission was carried on as a department of the State college under an appropriation of $10,000 per year. During 1914 the estimated amount available for the use of the commission was $80,000.

A very radical change was made whereby the board of supervisors of each county was required to appoint a county engimeer who has general charge of the road and bridge work throughout the county. Under the present law all of the bridges regardless of size or location excepting those inside the cities and towns, are built and maintained by the county board of supervisors under plans and specifications issued by the commission.

During the past year no important changes have occurred in the organization of the commission. At present the commission is composed of three members, namely, A. Marston, chairman, J. W. Holden, and H. C. Beard, and a highway engineer, Thos. H. MacDonald. The detailed work of the commission is carried on in three departments, the designing department, educational and field department. The State has been divided into six sections over which is placed a district engineer under the direct charge of the field department. At present the commission force consists of about thirty employes.

The highway commission experimented very satisfactorily with convict labor during the season. A stretch of concrete road 1.36 miles in length was constructed in Louisa County under highway commission supervision entirely, with twenty-two inmates from the Anamosa reformatory. The men were paid twenty-five cents per hour for their work, and out of this they paid the entire expense of their camp and of the one camp guard in charge of the men. They dressed like ordinary workmen, the prison stripes being barred. They proved to be willing and intelligent workmen and better results in some respects were secured than with ordinary labor. A second crew was used under the direction of State Highway Engineer MacDonald on road and bridge work at the Iowa State College campus and farm at Ames. Equally satisfactory results were secured there. The wages drawn by the convicts in both camps during the season totaled $9870.

The commission is at present conducting a series of lectures in each of the counties of the State on road work. We are also issuing a monthly publication entitled a *Service Bulletin*. This bulletin is being sent to all the road officials in the State as well as others interested in road work. This bulletin contains the current news relative to important road projects and general information of interest to road workers. This bulletin also contains current quotations and prices on road and bridge material, and all information and data concerning contract lettings, etc.

During the past year the commission has prepared special plans and designs for over $2,250,000 worth of bridge and culvert work. Standard plans have been issued for a number of the general types of highway bridges used by the State as well as standard cross sections for the road work. At present there is a great deal of interest being taken in the betterment of the highways in the State. The commission is endeavoring in every way possible to impress upon the road officials the necessity of maintaining the entire mileage of the highways in the State in a safe condition. A very marked improvement has been made in the past year in the condition of the roads and bridges.

During the past twelve months under the new law, a great improvement in the amount and character of road and bridge work has been apparent. During 1914, about $11,000,000 was expended from county, township, and motor vehicle tax. Eighty-five per cent of the automobile tax is returned to counties for use in permanent road work. Eight per cent is set aside for support of the highway commission. In 1914 this amounted to $80,000.

A one mill non-divertible drag tax producing nearly $1,000,000 annually must be levied by the townships for dragging purposes only.

THOS. H. MACDONALD,
State Highway Engineer.

Kansas

Total amount of State funds expended by or under supervision of State highway department during calendar year 1914, $9080.

The above amount is subdivided as follows:

General engineering	$8130
Administration	
Equipment	450
Other items	500
Traveling expenses (not paid by State)	600

Engineering or supervision furnished by State highway department for:
Work constructed.
1. Miles of road, 62; costing $30,000.
2. Number of bridges, 187; costing $235,000.

Engineering or supervision by State highway department where reports, inspections and estimates were furnished:
Miles of road, 350.
Estimated value, $6800.
Number of bridges, 68.
Estimated value, $150,000.

Total cash expenditure, exclusive of State funds, on all public roads and bridges of the State, outside of incorporated towns and cities during 1914, $5,541,057.

(From U. S. Office of Public Roads.)

Kentucky

The State department of public roads was organized July 1, 1912. The State appropriates $25,000 annually for the support of the department.

The department furnishes plans, specifications and estimates for all bridges over $500 in value. It furnishes surveys, specifications and estimates for all new roads and the same for all reconstruction when requested by the fiscal courts. The department also keeps up a continuous campaign along educational lines, by mailing bulletins for road information, by displaying road models at the State fair and some of the larger county fairs, by holding road meetings over the State and by furnishing speakers for road meetings in the various counties of the State. Since the organization of the department plans, specifications and estimates for about 337 bridges have been made, surveys for about 125 miles of new road have been made, about 400 miles of old road has been inspected and advice furnished. Four miles of road have been constructed under the direct supervison of the department.

The general assembly of 1914 passed a bill which levied a State tax of 5 cents on the $100 of taxable wealth, which is to constitute a State road fund to be redistributed to the counties applying for aid to the extent of one-half the cost of construction or reconstruction of public roads. No county to receive in any one year more than 2 per cent of the total fund.

Also another bill was passed, making roads connecting the county seats of adjoining counties on the most direct and practical route, public State highways, to be the first to receive State aid.

Two of the mountain counties have voted bond issues of $150,000 each.

ROBERT C. TERRELL,
State Commissioner of Public Roads.

Louisiana

During the year 1914, the highway department, board of State engineers, extended State aid to ten parishes for the construction of twelve highway projects aggregating 132.68 miles, of which 1.18 are shell roads, 65 miles gravel, and 66.50 improved earth. The estimate cost of construction is $400,000, the State contributing approximately $100,000, and the parishes the remainder.

State convicts were not employed during 1914 in the construction of State aid projects.

Concerning the expenditures made for highway construction in Louisiana undertaken by various authorities independently of the highway department, will state that no figures were compiled covering these expenditures for 1914, but a conservative estimate based on the information on hand would indicate the following:

Parish expenditures	$3,000,000.00
Municipal	2,000,000.00
Contracts let by highway department	400,000.00
Total	$5,400,000.00

The highway department, board of State engineers, will have available during 1915, approximately $130,000 for distribution among parishes applying for State aid. Figuring from present indications this department will construct and have under construction during 1915, approximately 200 miles of State aid projects to cost about $600,000.

Bonds are being issued and special taxes voted in many parishes of this State and there is no question but that highway construction *is* a real live issue in Louisiana.

CHAS. F. WOOD,
Secretary.

Maine

Lineal feet and cost of State aid road work done under supervision of highway department, 1914

	Feet	*Cost*
Gravel	704,916	$465,111.45
Earth	33,000	14,898.12
Macadam	19,222	26,987.94
Bituminous macadam	10,512	32,130.15
Concrete	8,283.9	32,849.58
Sand and clay	8,270	4,780.88
	784,203.9	$576,758.12
Cost of culverts included in the above		49,573.10
No. of feet of V drain cost not separated	164,247	
Cost of bridges under special appropriations		54,907.93

STATE HIGHWAYS

Contracts let for bituminous macadam surface	27.14 miles
Contracts let for gravel surface	104.78 miles
Total mileage	131.92 miles

Of above work 77 per cent completed is equivalent to 101.58 miles.

Expenditures on bituminous macadam	$172,265.00
Expenditures on gravel surface	534,413.78
Total expenditures	$706,678.78

NOTE: Average cost of bituminous macadam computed from completed work is $10,109.46 per mile.

Average cost of gravel computed from completed work is $5,870.57 per mile.

MAINTENANCE

760 miles of State and State aid highways have been maintained at an approximate cost of	$110,000
Of this the State has furnished about	85,000
and the municipalities have paid the remainder	25,000

SUMMARY

State aid highways	$576,758.12
State highways	706,678.78
Maintenance	110,000.00
Special resolves	54,907.93
Total expenditure of department	$1,448,344.83

PAUL D. SARGENT,
Chief Engineer.

Maryland

(January 1, 1915)

	COMPLETED		UNDER WAY	
	Miles	Cost	Miles	Estimated cost
State roads	626.60	$6,858,615.49	*267.51	$4,086,949.79
State aid roads	257.41	1,877,997.09	36.71	452,276.19
Baltimore and Washington road	28.74	439,579.50	1.36	23,373.25
Baltimore and Annapolis road	17.03	289,738.51	Bridge	36,000.00
	929.78	$9,465,930.59	305.58	$4,598,599.23

* 127.81 miles—95 per cent completed.

HENRY G. SHIRLEY,
Chief Engineer, State Roads Commission.

Massachusetts

We laid out about 59 miles of State highway during the year, and completed work on over 76 miles that we laid out in 1913–1914.

The commissioners have constructed in all under the "small town" act over 430 miles, and with money available from the motor vehicle fees for use in towns, nearly 160 miles of road have been constructed and improved, and from special appropriations, over 38 miles have been constructed.

We have available for construction $1,000,000 for State highways and small town roads. There was appropriated $350,000 from the State tax for the maintenance of State highways, and $647,000 was available from net motor vehicle fees, making a total of $997,000 available for the maintenance of State highways. There was $162,000 available for through roads in the towns from the motor vehicles fees. The municipalities contributed $136,000 in connection with this work.

The commission has been doing work in 339 cities and towns under the "small town" act, State highway, motor vehicle fees, etc., out of 353 in the State.

Of State highways constructed in 1914 over 35 miles were bituminous macadam; 5 miles water-bound macadam, which will be covered with bituminous binder; 3 miles gravel; 5½ miles sand and asphaltic oil; 4 miles macadam covered with a heavy asphaltic oil; 2¼ miles of concrete; 3⅛ miles of bituminous gravel; 2½ miles sand and clay, and over 15 miles of graded road to be surfaced later.

We have been continuing to fill in the gaps on the through roads as rapidly as possible, and almost all the cities and towns have co-operated so that a number of the main through lines will soon be completed.

During the year we used bituminous materials on 516 miles of State highway, and resurfaced 70 miles of the older roads; 37½ miles were also widened. Out of our total of 1039 miles of State highway, 956 have now been treated with some form of bituminous material, either in resurfacing or on the surface.

The most noticeable thing in Massachusetts is the interest that has been aroused in almost every single town in the State, in good roads. More and more towns are asking for engineering advice, and more and more towns are making appropriations to be used in connection with the allotments to be made by the commission in improving the main roads in the towns.

The fact that we actually did work and made appropriations in over two-thirds of all the towns and cities in the commonwealth shows how the good road improvement has grown in the State.

Total expenditures in 1913 for road purposes were as follows: expenditures by the towns $3,318,742; expenditures by the cities $6,645,985; a total by both cities and towns of $9,964,727. The mileage and classification of improved roads at the close of 1913 were as follows: gravel roads 8525 miles; plain macadam roads 2075 miles; bituminous macadam roads 419 miles; macadam with oil or tar coat 1146 miles; pavement 452 miles, a total of 12,617 miles.

WM. D. SOHIER,
Chairman, State Highway Commission.

Michigan

The total length of road in the State is estimated to be 70,000 miles, of which it is estimated that approximately 4500 miles are hard surfaced. No roads have been built entirely at the expense of the State, but there are 11 miles under construction at the expense of the State by special appropriations, the total length of roads constructed partly at the expense of the local subdivision, is 2400 miles and it is estimated that about 500 miles are under construction at joint expense of State and local subdivisions. No roads are maintained entirely at the expense of the State but the entire 2400 miles of State road are maintained by townships and counties under the supervision of State highway department. During the fiscal year ending July 1, 1914, 689 miles of road were accepted as State rewarded roads. Out of this mileage, 45 miles were located on the trunk line. The total expenditure from State funds during this fiscal year was as follows: ordinary State reward, $464,093, and trunk line reward, $117,643. Under the trunk line system the law provided that all bridges over 30-foot span, located on the trunk line were to be built by the State, so during this fiscal year, 22 bridges made up of concrete arches, through girders, reinforced I-beam bridges were built. The total expenditure of these bridges amounted to approximately $100,000.

LEROY C. SMITH,
Deputy State Highway Commissioner.

Minnesota

Clearing and grubbing	3694.90	acres	Cost	$197,312.01
Ditching	409.98	miles		194,696.14
Grading	2150.87	miles		1,478,826.00
Gravelling	537.43	miles		366,892.73
Macadam	29.5	miles		83,988.60
Other surfacing	78.58	miles		123,155.22
Concrete culverts, 36″ and less	1328			79,602.38
Concrete culverts, over 36″	316			109,434.13
Corrugated metal culverts, 24″ in diameter	4678			$105,405.32
Over 24″ in diameter	346			21,237.59
Miscellaneous work				41,945.22

The total cost of all road and culvert work was $2,802,995.96. This does not take into consideration the maintenance which was supervised by the department and on which the cost was $323,111.27, as shown by the maintenance report.

Bridge work amounting to 342 bridges at an average cost of $2000 is shown in report of bridge department. The average length of these bridges is 40 feet.

On State road and culvert work we have the following amounts reported:

Clearing and grubbing	918.50	acres	Cost	$45,683.20
Grading	637.47	miles		792,394.51
Turnpiking	466.53	miles		110,114.80
Gravelling	276.46	miles		229,945.19
Sand clay	14.07	miles		10,658.52
Concrete	9.95	miles		67,568.19
Macadam	4.52	miles		18,124.38
Corrugated metal culvers, 24″ and less	46, 164	lin. ft.		47,893.61
Over 24″ in diameter,	2,331	lin. ft.		
Concrete culverts, 3′ x 3′ and less	25,007	lin. ft.		
Concrete culverts, 3′ x 3′ diameter	3,864	lin. ft.		118,850.72

The State road construction figures give an average cost of $1243 per mile of grading; $236 per mile of "turnpiking" or blade grader work; with a general average of $830 per mile for dirt construction. The average cost of gravelling on State roads is $831.70 per mile. This includes all gravelling which would probably average about 1000 cubic yards per mile. The average cost of maintenance was $44.67 per mile and ranged from $7.77 in Cottonwood County, to $280.65 in Ramsey County. This work includes general repairs and in counties of higher valuation resurfacing of improved roadways was included in this cost.

Total estimated road mileage in State, 91,890 miles.

Estimated mileage of improved roads, 9934, or 10.8 per cent of the total.

State road mileage, 11,401.45 miles or 12.4 per cent of the total.

Total land area, 80,858 square miles, or 0.88 of a square mile per mile of road.

Total valuation $1,369,790,302, or $14,907 per mile of road.

Total population by last census 2,075,708 or 22.5 person per mile of road.

GEORGE W. COOLEY,
State Engineer.

Missouri

Approximately $127,000 of State funds were expended in dragging the system of inter-county seat roads comprising about 10,000 miles.

(From the U. S. Office of Public Roads.)

Mississippi

Mississippi is rapidly adopting more modern methods of road administration. Of a total of 80 counties, only 9 still retain the old "overseer" system. From 1911 to the close of 1914, a total of $5,500,000 road bonds had been issued by the various counties of the State. From these funds there has been constructed about 600 miles of macadam, gravel, slag and shell roads, about 1200 miles of sand-clay and about 6000 miles of earth roads have been graded.

(From U. S. Office of Public Roads.)

Montana

Total amount of State funds expended by or under supervision of State highway department during calendar year, 1914, $13,515.68.

The above amount is subdivided as follows:

General engineering	$850.00
Administration	5124.00
Equipment	5000.00
Other items	1756.03
Transportation and postage	785.68

Engineering or supervision furnished by State highway department for 31 miles of road, costing $35,000.

Total cash expenditure, exclusive, of State funds, on all public roads and bridges of the State, outside of incorporated towns and cities during 1914: $4,089,739.34.

Cash on hand Dec. 1 in counties.................	(Road)	$950,446.78
Cash on hand Dec. 1 in counties...............	(Bridge)	521,648.56

George R. Metlen,
Secretary, Montana Highway Commission.

Nebraska

The State engineer, Mr. D. D. Price, reports that the State advisory highway commission is composed of three members who are not paid any salary or expenses. Such work as has been done during the year has been largely under the direction of Mr. Price. He states that his time has been practically taken up with designing bridges and looking after bridge work under the State aid bridge law and also under the law passed at the last session requiring that all county bridges costing over $500 shall be designed and built from plans and specifications prepared by the State engineer. He states that his office has completed a standard set of plans and that the work of collecting statistics on road work is now under way.

Nevada

There have been no changes in the highway laws of this State since I sent you the last report on that subject. Our last legislature failed to make any appropriation to continue the construction of roads with convict labor and there is no work being carried on at this time under that law.

A great deal of work is being carried on by the individual counties, under the law which permits the county commissioners to appoint road supervisors to repair and construct county roads.

It is the plan of the present administration to obtain statistics regarding the best method of constructing roads and to recommend to the legislature the passage of a law which will enable the State to carry out the construction of roads on a definite and comprehensive plan which will result in permanent highways and to construct a system which will be best for the State and the transcontinental traffic.

W. M. Kearney,
State Engineer.

New Hampshire

The total length of roads in the State is estimated, to be approximately 15,116 miles, of which it is estimated that 1026 miles consist of hard surfaced roads. Considerable of this mileage is gravel composed of hard pan (clay and metal, the latter being not less than 60 per cent of the total). About 130 miles of road have been completed entirely at the expense of the State, but most of these are only graded roads. There are no State roads under construction. The total mileage of all roads completed partly at the expense of the State and partly by local subdivisions is 1026 miles, and no mileage is reported uncompleted. A total of 130 miles of State roads is now being maintained by the State. All roads built at the partial cost of the State are maintained under the supervision of the State highway department with contributions from the town and the State. The total expenditure by the State in 1914 for construction was $325,000 and for maintenance $157,155.38, in connection with which the towns expended $225,000 for construction and $78,000 for maintenance. A new State bond issue of $300,000 was authorized by the legislature in 1913. No convict labor was used in road work.

S. Percy Hooker,
State Superintendent of Highways.

New Jersey

During the fiscal year 1914, 102.05 miles of new road were constructed at total cost of $1,328,742.03, on which State share was $558,026.85. For repair on 2000 miles, $2,135,210.79 was spent, on which State share was $679,969.60. Total State money expended in 1914 for all purposes, $1,371,153.25. Convict labor amounting to $99,980.15 was also used.

E. A. Stevens,
State Highway Commissioner.

New Mexico

Money for road purposes in the State of New Mexico may be divided into two classes: The first, is that paid into the State treasury for the use of the State highway commission for the construction and maintenance of roads and is obtained from the following sources: A one mill levy on total assessed valuation of the State; State revenues derived from automobile licenses; one-half of the amount paid by the National Forest Reserves to Grant and Socorro Counties, being one-half of the 25 per cent which the Forest Reserve pays to the State for school and road purposes; the amount derived from the sale of State highway bonds.

The second class, is that raised by each county for use in that particular county as follows: A levy not to exceed three mills for general road and bridge purposes; a levy not to exceed five mills for certain specific roads designated in the levy which is spent under the supervision of the State highway commission; a levy varying in amount with assessed valuation of the county for building specifically designed bridges, this money being spent by the county commissioners after plans for the bridge have been approved by the State engineer; proper proportionate amount of money derived from Forest Reserve income; money derived from the three dollar road tax which is payable either in money or labor (this report includes only the amount paid in cash); county bond issues for road purposes.

Under the first class $81,000 was obtained under the one mill levy, $8019 under delinquent taxes and $21,000 from automobile licenses, amounting to a total of $110,019. A total of $277,322.12 was expended by the various counties for roads and bridges to which should be added the following expenditures:

Road equipment, $10,629.22; maintenance and repair, $7501.79; bond expense $2218.41; office equipment $778.90; transportation $119.80; miscellaneous expense $60.27; total $21,308.39; grand total by counties, $298,630.51.

During the period beginning July 11, 1912 and ending November 30, 1914, there were constructed 113 miles of graded roads with surface and culverts; 51 miles of graded roads with culverts; 34 miles of graded roads in canyons and mountains; 159 miles of machine graded mesa roads.

James A. French,
State Engineer.

New York

All of the original $50,000,000 bond issue has been appropriated and is accounted for as follows:

Status of funds

Money actually expended on contracts	$46,829,405.94
Amount obligated on existing contracts or by expedited routes not under contract, already appropriated by the legislature	3,170,594.06
Amount appropriated by the legislature out of the second fifty million	15,000,000.00

(This amount has all been obligated by existing contracts or has been apportioned to roads now ready for letting.)

Status of highway construction

	miles
State and county highways improved, January 1, 1914	4,304.07
State and county highways completed and accepted during the year 1914	863.12
State and county highways now under contract	1,148.28

(A very large amount of this mileage is practically completed and open to traffic.)

Total	6,315.40
Remaining State and county highways to be improved	5,671.07
Total	11,986.47

New construction

During the year 1914 there has been advertised for construction, 1167.32 miles of State and county highways, the appropriations for which are as follows:

State appropriation	$16,462,073.20
County appropriation	2,072,373.62
City or village appropriation	1,112,970.69
Total	$19,647,417.51

J. N. CARLISLE,
State Commissioner of Highways.

North Carolina

The State does not make any direct appropriation for highway improvement but the State geologic board is authorized to make investigations and give advice concerning highway improvement, and an annual appropriation of $5000 is made for this purpose. The legislature of 1913 authorized the working of State convicts on two special highways in the State; one in Henderson County, known as the "Hickory Nut Gap Road," and one in Madison County as a link of the central highway. Altogether, ninety-two convicts are at work on these highways, fifty in Henderson, and forty-two in Madison County. The State pays the entire cost of feeding, guarding and caring for the convict. The work is done under the supervision of the geological survey.

At the special session of the general assembly held in September, 1913, a law was passed providing that county, townships or good roads districts desiring to use convict labor for highway improvement shall apply to the geological survey for plans or approval of plans for the work, after which application shall be made to the board of State prison directors for the number of convicts desired for the work. The work done with these convicts is to be under the direction of the highway division of the State geological survey. This division must locate the roads to be built by the convicts. The law further provides that counties, townships or road districts using convict labor shall pay to the State not less than one dollar per day for each laborer, furnish quarters, firewood for camp use and overseers to direct the work, and that all other expenses shall be borne by the State board of prison directors.

Thus far, only one county has taken advantage of this act, and there are now about fifty convicts at work in Randolph County.

JOSEPH HYDE PRATT,
State Geologist.

Note:—The 1915 Legislature passed an Act in March establishing a State highway department with an appropriation of $10,000.

North Dakota

The State of North Dakota has made some progress in the interests of good roads during the year just closed. The 1913 legislative assembly passed a proposed amendment to the State constitution, which is to give the State the power to grant aid in highway construction. This proposed amendment was submitted to the people at the general election on November 3, 1914, and was adopted. A campaign of education has been carried on by various organizations and the sentiment is much more favorable for State aid than ever before. It is therefore probable that at the 1915 session of the legislature a State aid law will be enacted.

The 1913 assembly also created a State highway commission consisting of the governor of the State, the State engineer, and one member to be appointed by the governor, the governor being chairman of the commission and the State engineer the secretary. As yet no funds have been placed at the disposal of the commission and the members serve without compensation, their duties being largely advisory. It is the duty of the commission to require the State engineer to prepare county maps showing the location of bridges and culverts and all the roads now being used. This work is now nicely under way. The highway commission also is to prepare maps showing proposed State highways.

A law was enacted also at the last session of the legislature, making it the duty of the State engineer to prepare plans and specifications of bridges and culverts when requested to do so by county commissioners or township supervisors or others having jurisdiction over highway work. The office has made a number of plans of both bridges and culverts under this law.

Counties are now enabled to employ convict labor on roads. Counties taking advantage of this law are required to pay the men at the rate of 25 cents per day and to pay the guards provided by the warden of the penitentiary, as well as provide board for the convicts.

The 1911 legislature created the office of county superintendent of highways leaving it optional with the counties as to whether or not they should establish such office.

The automobile license law which has been in effect since 1911 has resulted in a refund to the counties of the State of $17,661 in 1911, $22,800 in 1912, and $33,660 in 1913 and $49,898 for 1914. These funds are expended in the maintenance of highways, under the direction of county superintendents of highways or of county commissioners.

JAY W. BLISS,
State engineer.

Ohio

Road mileage contracted and contract price

(Data taken from Annual Report)

1906–1907	33.08 miles	Contract price	$223,981.69
1907–1908	30.63 miles	Contract price	229,599.48
1908–1909	63.01 miles	Contract price	534,945.77
1909–1910	72.87 miles	Contract price	626,574.18
1910–1911	60.87 miles	Contract price	455,419.11
1911–1912	154.98 miles	Contract price	1,337,387.85
1912–1913	157.61 miles	Contract price	1,386,505.26
1913–1914	495.09 miles	Contract price	6,877,299.95*
Totals	1068.14 miles		$11,671,713.27

Type and length of road mileage contracted

YEAR	BRICK	CEMENT CONCRETE		MACADAM		GRAVEL	GRADED	TOTAL
		Plain surface	Bit'd surface	Plain	Bituminous			
1906–07	3.21			29.87				33.08
1907–08	8.51			19.62			2.50	30.63
1908–09	20.45			36.09	6.47			63.01
1909–10	21.25	1.49		38.46	11.67			72.87
1910–11	11.54		1.25	35.33	10.49		2.26	60.87
1911–12	33.19	5.95	34.44	58.40	15.44	7.56		154.98
1912–13	29.30	17.05	5.25	83.50	7.74	4.09	10.68	157.61
1913–14	156.49	120.54		181.46	26.17	4.38	6.05	495.09
Totals	283.94	145.03	40.99	482.73	77.98	16.03	21.49	1068.14

* Includes drainage structures. Five contracts for bridge work only, amounting to $33,233.83, not included.

Contracts completed, 1906–1914

1906–1907	1.00 miles	Actual Contract Cost	$10,332.40
1907–1908	24.10 miles	Actual Contract Cost	171,432.37
1908–1909	34.23 miles	Actual Contract Cost	260,623.38
1909–1910	47.70 miles	Actual Contract Cost	368,982.04
1910–1911	60.83 miles	Actual Contract Cost	508,921.54
1911–1912	79.96 miles	Actual Contract Cost	645.946.07
1912–1913	167.45 miles	Actual Contract Cost	1,427,969.46*
1913–1914	141.26 miles†	Actual Contract Cost	1,523,374.88†
Totals	556.53 miles		$4,917,582.14

* Includes Force Account Work amounting to $32,022.25.

† Excludes Force Account Work.

Maintenance and repair work

Done under the supervision of the State Highway Department

YEARS	TOTAL MILEAGE ORIGINAL IMPROVEMENTS	COST			AVERAGE COST PER MILE
		State's share	County's share	Total	
1911–1912	7.87	$ 1,251.91	$ 3,755.73*	$ 5,007.64	$635.00
1912–1913	69.59	15,359.19	6,295.56	21,654.75	311.00
1913–1914	307.45	165,653.80	26,372.73†	192,026.53	625.00
Total.......	384.91	$182,264.90	$36,424.02	$218,688.92	$568.00

* Part paid by townships through county commissioners.
† $494.68 paid by Penna. R. R. Co.

Proposed work 1915

To be paid wholly by State..............................	54 miles
To be paid by State and county..........................	478 miles
Total..	532 miles

Of this at least 50 miles will be grading without paved surface.

Resolutions and applications from county commissioners for the improvement of inter-county highways, received January 21, 1915, cover 8318 miles, or 84.4 per cent of the total mileage of the inter-county highway system.

Highway statistics

Mileage outside of municipalities

TYPE OF ROAD	ALL PUBLIC ROADS MARCH, 1914	INTER-COUNTY HIGHWAYS* JANUARY, 1915	MAIN MARKET ROUTES* JANUARY, 1915	STATE HIGHWAY IMPROVEMENTS	
				Contracts let	Contracts completed
Earth Roads.................	55,268	3318.9	740.4	21.49†	1.73†
Gravel improvement.........	15,652	2896.1	651.3	16.03	14.53
Macadam improvement......	12,144	3443.8	1268.9	560.71‡	339.22§
Brick improvement..........	440	197.0	95.2	283.94	140.02
Concrete improvement.......	78	17.9	18.9	185.97¶	66.20‖
Miscellaneous types..........	99				
Totals.....................	83,681	9873.7	2774.7	1068.14	561.70

* Mileage of Routes correct to January 11, 1915. Types of improvement correct to January 1, 1913. There are 490 Inter-county Highways and 22 Main Market Routes.
‡ Bituminous 77.98 miles.
§ Bituminous 53.83 miles.
† Graded roadway.
¶ Bituminated surface 40.94 miles.
‖ Bituminated surface 30.97 miles.

James R. Marker,
State Highway Commissioner

Oklahoma

During the last two years the amount of money levied by the various counties and the township has approximately been between three and four millions of dollars for roads and bridges.

Road improvement bonds. Bond issues for roads and bridges have been authorized by the votes of the several communities and approved by the attorney-general to the amount of $210,000, as follows:

Township	*County*	*Amount*
Stonebluff	Wagoner	$4,500
Berwyn	Carter	15,000
Bettina	Beckham	7,500*
Weleetka	Okfuskee	25,000*
Sapulpa	Creek	50,000
Eagle	McCurtain	17,000
Tiget	Creek	20,000
Wekiwa	Tulsa	16,000
Poteau	LeFlore	20,000
Talihina	LeFlore	20,000
Howe	LeFlore	15,000
		$210,000
	Bridge Bonds	
Saline	Mayes	$19,800
Tiger	Creek	27,000
		$46,800

Engineering department. A complete series of standard steel bridge plans has been worked out and adopted all with live loading capacity of 150 pounds per square foot, with a factor of safety to conform to existing State standards. Plans and specifications for I-beam bridges from 12 feet to 36 feet in the multiple of two for beam girders 38 and 40 feet, riveted spans from 45 feet to 80 feet, in multiple of five and standard high truss pin connecting spans from 85 feet to 100 feet in multiple of five. This gives every county so desiring plans for any class of bridge desired, which insures safety, and, when conformed to value for the money, either steel or reinforced concrete.

Engineering work consisting in some cases of both, surveys and supervision of construction, was furnished six different projects.

(Compiled from Biennial Report, Oklahoma, 1914.)

Oregon

The approach of the Panama-Pacific Exposition awakened the people of Oregon to the necessity of immediately improving the principal trunk roads of the State. Taking advantage of the existence of a State highway department, five counties raised in 1914, $1,700,000, the greater part of which has been spent in 1914 on the Pacific highway and the Columbia highway. This work has been under the supervision and direction of the State highway engineer. In addition to this amount, the highway commission has expended the sum of $225,000 on the improvement of sections of State road in various counties.

The county courts, during the year 1914, expended approximately $4,000,000 on county roads and bridges. During the eleven years ending October 1, 1914, the county courts spent $21,972,128.74 on the construction of county roads and bridges.

There are 37,624 miles of public road in the State. Of this mileage, 964 miles have been surfaced with crushed rock; 3745 miles with gravel; 232 miles with plank; and 25 miles with hard surfacing.

H. L. Bowlby,
State Highway Engineer.

Pennsylvania

1. This State has a total of 97,900 miles of roads.

2. There are approximately 1856 miles of State highway routes and State-aid roads, constructed wholly by the State highway department of Pennsylvania in good condition. In addition there are sections of highways constructed by counties and townships independent of the State, information regarding which is not available. There are 431 miles of improved toll roads on State highway routes.

3. Mileage completed at total expense of State is 836 miles on December 31, 1914.

4. No mileage uncompleted under contract at total expense of State on December 31, 1914.

5. Mileage of State-aid highways built under the provisions of acts since June 1, 1911, is 118 miles, and 905.1 miles of State-aid highways were built under the provisions of acts previous to June 1, 1911, making a total of 1023 miles completed.

6. Mileage of State-aid contracts not completed December 31, 1914, is 36 miles.

7. Total miles now being maintained at total expense of State is 8827.

8. Of the 1023 miles of improved roads built by State-aid, about 424 miles are not on State highways, and are maintained by the State and township or borough, each bearing 50 per cent of the expense. The remaining 599 miles of State-aid highways are on State highway routes and maintained at total expense of the State. A small percentage of the above is constructed of brick and asphaltic concrete.

9. Contracts let during the calendar year 1914:

	Miles
Telford macadam	3.00
Brick block	32.28
Asphaltic bituminous macadam	19.11
Asphaltic concrete	5.63
Amiesite	4.58
Total	64.60

Practically all highways are 16 feet wide. Some borough work is wider.

10. By action of the last legislature, the creation within the State highway department of a bureau of township highways was made mandatory, and the State highway commissioner made responsible for the supervision of all the township highways and bridges constructed and improved, maintained in whole or part by the aid of State moneys; requiring him to prescribe rules and regulations; fixing the duties of township officers in respect to all highways and bridges under his jurisdiction; to compile statistics relating to such highways throughout the State; collect traffic census and such other information in regard thereto as he should deem expedient; and call meetings or conventions of township supervisors at such times and places as he deems wise. In addition the State highway commissioner is responsible for the distribution of bonus funds to townships which are on a cash tax basis, such distribution to equal 50 per cent of the amount of cash tax collected when such 50 per cent would not exceed $20 per mile, this distribution being provisional upon the township treasurer filing a certified copy of bond given by him and an agreement executed covering the proposed expenditure of State money to be received.

The total amount of road taxes collected in cash by townships during the year 1913, was $5,410,424.27 and the amount to which they are entitled, viz: 50 per cent when not exceeding $20 per mile was $1,431,975.89. The total amount therefore to be distributed for the current year, viz: $200,000, represents a pro rata distribution of 13 per cent only, of the full amount which they should receive, this being due to the fact that $250,000 only was appropriated for the maintenance of this bureau, and for distribution of tax bonus for the two-year period ending the first Monday in December, 1914. The balance due the townships for the year ending the first Monday in December, 1913, was $1,231,975.89.

A uniform system of accounts devised by this department likewise has been installed throughout the State, and all necessary books, blanks and forms have been furnished the various township officers.

The first deputy State highway commissioner has direct charge of this bureau.

11. In 1913, a maintenance department was established under the direct charge of a maintenance engineer, with a view of standardizing and systematizing of all maintenance work under the jurisdiction of the highway department. This division is now so systematized that the operation of each unit of the maintenance force in the field is reflected in this department immediately upon the expenditure of any money, and each dollar expended is so recorded that the department can locate, by referring to station numbers reported, the 100 feet upon which expended and for what used.

Since the organization of this division 6300 miles of dirt roads have been dragged, shaped, and ditches and drains opened, in addition to the reconstruction throughout of approximately 500 miles of macadam roads.

12. Under the provisions of the new automobile act, dated July 7, 1913, effective January 1, 1914, all moneys derived from the registration of automobiles and license fees were specifically appropriated for the use of the State highway department, to be used in the maintenance, construction, improvement and repairs of State highway routes and State-aid highways. The fees derived from this source during the year 1914 approximated $1,185,000, which, however, were withheld from the department until July 14, 1914, pending a decision as to the constitutionality of this method of appropriating funds. Since that date, however, practically all the above funds have been expended for the maintenance of State highway routes throughout the State.

13. No convict labor was used.

14. Instructions to superintendents were issued from time to time under the new system of maintenance.

15. The answer to question No. 9 shows a decided tendency from water-bound macadam towards a more permanent type of construction.

S. D. Foster,
Chief Engineer State Highway Department.

Rhode Island

The legislature 1914 made no appropriation for construction. The work of the State board of public roads, therefore, was devoted to the maintenance of the 325 miles of State roads. The total expenditure for the year was $199,598.34 of which $4920.70 was for construction of roads and $23,518.79 for bridges derived from the appropriation of previous year. Since the creation of the board in 1902, there has been received for highway purposes by appropriations, by bond issues, from the automobile department, and from fines, approximately $3,345,555.46 to January 1, 1915.

(U. S. Office of Public Roads.)

South Carolina

A very comprehensive report on road mileage and expenditures compiled from the report of the State commissioner of agriculture and industries, to January 1, 1914, appeared in the 1914 *Good Roads Year Book*. The commissioner reports this year that no later information is available in his department but calls attention to the successful operation of the maintenance project on the South Carolina portion of the Washington-Atlanta highway. This maintenance project involves the coöperation among the United States Office of Public Roads, the American Highway Association, State commissioner of agriculture and industries of South Carolina, and the various county authorities on the route of the highway. The project is discussed elsewhere in this volume in detail.

South Dakota

The commission is operating under an act of July, 1911, which makes the function of the commission of an educational nature. Their duty is to give advice and assistance to the various counties. No State-aid is granted. Since 1912 road expenditures by counties has increased from $100,000 until in 1914 more than $550,000 was expended in addition to levies by townships which is estimated at $500,000. The chief interest in South Dakota has become concentrated on several trunk line roads such as the Meridan road, Winnipeg to Gulf highway; the Chicago, Black Hills, Yellowstone Park to Coast highway; the Minneapolis, Aberdeen Yellowstone road; the Watertown, Redfield, Gettysburg, Belle Fourche road; the Sioux Falls, Salem, Iroquois road; the South Dakota scenic highway; and the Sioux City Platte, Chamberlain road and the Washington highway.

E. C. ISSENHUTH,
Chairman, State Highway Commission.

Tennessee

No State highway department has yet been established and in consequence an authoritative report for road activity throughout the State cannot be obtained. A large number of counties have issued bonds and have constructed excellent highways. It is probable that the legislature this year will give serious consideration to the establishment of a State highway department as a bill has already been favorably reported having that purpose in view.

Texas

No State highway department has yet been established and it has been impracticable to obtain a comprehensive report showing the progress of road improvement throughout the State. The county is the unit of administration in Texas and a large number of the counties have made great progress through the issuance of bonds.

Utah

During the year 1914, there have been graded 314.48 miles of road; 59.10 miles have been surfaced; 2.70 miles of macadam road have been constructed, and 4.4 miles of concrete road have been built.

Four hundred and forty-six culverts have been constructed of concrete, 437 metal culverts have been installed, and 48 stone culverts have been constructed.

Sixty-two bridges were constructed of which 12 were of concrete, 5 of steel and 45 of wood.

E. R. Morgan,
State Road Engineer.

Vermont

Our work has proceeded in 1914 along our regular lines, with but little of a spectacular nature to bring to attention. We expended on improvement of our selected highways, which was 4000 miles out of 15,000, some $450,000. By improvement, we mean construction. On maintenance, we expended something over $200,000. Of these amounts, some $115,000 for improvement was supplied from the towns, as well as over $100,000 for maintenance.

Our type of road remains the same, gravel or gravel-telford.

Our plan of improvement remains the same—building no long stretches of road, but constantly improving the worst places throughout the entire system of 4000 miles. In this way, we have no very poor roads at all, after the Spring roads are dried out, and we have hundreds of miles of very delightful roads for the public travel. We have built some 200 miles of road in 1914. We are not aware of any known type of road, that will answer the needs of Vermont so well as earth roads.

M. E. Shedd,
Clerk, State Highway Department.

Virginia

Roads built during the year ending September 30 1914

	Miles	Cost	Average cost per mile	
Macadam—Money Aid	85.11	372,743.46	$4,379.55	
Convict Labor	67.03	286,655.65	4,276.53	
	152.14	659,399.11	4,334.16	Grading reported 1913
Macadam—Money Aid	42.21	140,113.89	3,319.45	
Convict Labor	4.10	9,424.60	2,298.70	
	46.31	149,538.49	3,229.07	
Gravel—Money Aid	64.08	128,801.69	2,010.00	
Convict Labor	39.53	74,659.92	1,889.17	
Total	103.60	203,461.61	1,963.91	
Soil or Money Aid	300.62	251,676.08	837.19	
Sand-clay Convict Labor	128.39	148,161.87	1,153.99	
	429.01	399,837.95	932.00	
Soil with stone base—Money Aid	1.07	4,868.01	4,945.54	
Soil with stone base—Con. Labor	4.14	12,990.65	3,137.83	
Shale-Convict Labor	3.44	11,695.38	3,399.80	
Grading—Money Aid	100.93	222,454.73	2,204.05	
Convict Labor	2.85	3,185.82	1,117.83	
	103.78	225,640.55	2,174.21	
Shell—Money Aid	2.66	10,876.08	4,088.75	
Concrete—Money Aid	.84	11,858.74	14,117.54	
Bituminous Macadam	7.68	76,843.73	10,005.69	

Bonds issued for road building since October 1, 1913

Accomac	(Pungoteague District)	$50,000.00
Brunswick	(Meherrin and Sturgeon)	125,000.00
Culpeper	(Salem District)	36,000.00
Fairfax	(Mount Vernon District)	90,000.00
Montgomery	(Blacksburg District)	100,000.00
		$401,000.00
To October 1, 1913		6,274,100.00
Total		$6,675,100.00

GEORGE P. COLEMAN,
Commissioner.

Washington

Two classes of highways are provided for by State law, namely, State roads and permanent highways. The permanent highways are divided into two classes designated as primary and secondary roads. The primary roads authorized by the legislature follow specific routes and thus far have been designated as follows: Central Washington highway; Inland Empire highway; McClellan Pass highway; National Park highway; Olympic highway; Pacific highway; and Sunset highway. State roads to the number of 18, and which are designated by numbers, have been established and follow specific routes. These roads are all designated as secondary roads.

The total original appropriations for the primary highways aggregated $2,071,700.10. There had been expended by the State from April 1, 1905, to September 30, 1914, $1,472,899.55. The total original appropriations on the secondary roads, which included the various State roads, aggregated $717,584.91, and the total expended by the State from April 1, 1905, to September 30, 1914, amounted to $545,280.48. The total original appropriations for bridges amounted to $365,000 and the total expenditure by the State from April 1, 1905, to September 30, 1914, amounted to $253,680.01, of which the expenditures to September 30, 1914, amounted to $2,271,860.61.

On October 1, 1914, there had been completed, on the Inland Empire highway 64.5 miles; on the McClellan Pass highway 11.65 miles; on the National Park highway 15 miles; on the Olympic highway 24 miles; on the Pacific highway 25.2 miles; on the Sunset highway 38.3 miles, or a total completed on the primary highways of 178.65. On the secondary roads the following progress is reported as of October 1, 1914: State road No. 2, 7.4 miles; State road No. 4, which aggregates 155 miles in length, has been made passable its entire length although only a few miles have been constructed according to State standards; State road No. 5, appropriations and surveys made for a bridge across the Cowlitz River between Nesika and Cosmos; State road No. 8 aggregating 175 miles in length, $60,000 appropriated by the 1913 legislature for surveys and construction and 5½ miles in Skamania County; State road No. 10, an appropriation made by the 1913 legislature for surveys and construction in Chelan County $22,359 and in Okanogan County $8653, an expenditure of $20,500 has been made in improvements on this road in Chelan County and $8000 in Okanogan County; State road No. 11, an appropriation of $5000 was made by the 1913 legislature for surveys and construction; State road No. 12, $8653 was appropriated for work in Okanogan County.

Summary of permanent highway work from March 8, 1911, to September 30, 1914

Completed Contracts.

Type of Surface	Mileage	Completed Cost
Gravel (Spread loose)	71.90	$317,879.00
Gravel (Rolled)	25.55	106,606.00
Waterbound Macadam	63.46	320,367.00
Asphaltic Macadam	30.83	249,413.00
Warrenite Pavement	13.39	212,467.00
Concrete Pavement	38.41	447,363.00
Brick Pavement	17.52	455,523.00
Totals	261.06	$2,109,618.00

Of the foregoing completed permanent highway contracts there have been constructed on the line of roads designated by the 1913 legislature as primary State highways, 147.28 miles, at a total cost of $1,288,830.

Permanent highways under contract on September 30, 1914

Type of Surface	Mileage	Contract Price
Gravel (Spread loose)	48.08	$260,425.00
Gravel (Rolled)	67.56	298,628.00
Waterbound Macadam	62.09	386,808.00
Asphaltic Macadam	19.30	220,309.00
Warrenite Pavement*	*2.00	25,769.00
Standard Asphalt Pavement	3.97	59,124.00
Concrete Pavement†	†16.59	†160,053.00
Brick Pavement	5.24	163,196.00
Totals	224.83	$1,574,312.00

*Note: Warrenite pavement only 9 feet in width; balance of cost in macadam strip to make 16-foot surface.

†Note: Mileage of concrete pavement includes 4.2 miles of pavement only 7 feet in width balance 14 feet gravel.

Of the foregoing permanent highway contracts under construction at the date of this report, 102.31 miles are being constructed on primary State highway routes, total contract price, $720,331.

Permanent highway projects for which plans have been approved, but contracts not awarded September, 30, 1914

Type of Surface	Mileage	Estimated Cost
Gravel (Spread loose)	12.64	$43,988.00
Gravel (Rolled)	5.00	21,309.00
Waterbound Macadam	5.00	24,365.00
Totals	22.64	$89,662.00

Of the foregoing permanent highways projected at this date, 9.5 miles are on the routes of primary State highways, the estimated cost of which is $44,481. (From report of State highway commissioner 1912–14).

West Virginia

The West Virginia road bureau was created by the acts of legislature of 1913. On the 8th day of July, A. D. Williams of Marlinton was appointed chairman and chief road engineer; Geo. B. Chorpening of Clarksburg, and J. W. Lynch of Union, members; and Dean E. D. Sanderson of the College of Agriculture is a member by virtue of his official position. The legislature established a department of highway engineering at the university. There are students taking the regular course in civil engineering, making highway their major subject.

Special road school for benefit of road supervisors, county engineers and county officials was held here February 10 to the 20, 1914, and December 1 to the 10, 1914. The State has established a testing laboratory at the university, and worked prison labor on the roads, one camp in Berkley County, one in Pleasants County and one in Kanawah County did 8213 days work. The law provided that the prisoners in county jails shall work upon the public roads and county jail prisoners did 43,363 days work from June 1 to December 1, 1914.

Bonds have been voted in the following counties: Marion $700,000, Mercer $500,000, Pleasants $60,000, Wetzel $150,000, Cabell $300,000, Hancock $350,000, Wood $180,000. The counties of Wood, Marion Cabell and Hancock are constructing brick roads. Logan County has voted $60,000 for bridges. The county of Mercer is constructing macadam and earth roads. The county of Wetzel is using the amount of $150,000 in regrading its roads. Great interest is being taken in better roads in all parts of West Virginia.

A. D. Williams,
Chief Road Engineer.

Wisconsin

The State-aid law was passed by the legislature in 1911, and at that time an annual appropriation of $350,000 was made. This did not prove enough to meet the State's full one-third, as proposed by law, as 511 towns voted a total of $422,163 for road improvement, and 125 towns voted a total of $55,133 for bridge improvements.

In 1912 the amount available for State-aid was $350,000 plus $28,000, the latter amount being 25 per cent of the net proceeds of the automobile fund of the State. It was seen, however, that $378,000 was totally inadequate to meet the demands of the towns which asked for $830,000. When the legislature met in January 1913, they made an additional appropriation to meet the demands of the towns. There was, therefore, available for 1913 work, $2,500,000 in round numbers.

There was available for construction in 1914 the sum of $4,330,000, made up of a State appropriation of $1,230,000 and town and county appropriations of $3,100,000. Construction is estimated to have been as follows:

	Miles
Concrete roads	60
Stone macadam roads	340
Gravel macadam roads	210
Shale or clay surfaced roads	110
Graded but not surfaced	540
Total	1260

State aid bridges constructed about 350.

The 9-foot stone, gravel, macadams, and earth have been the leading types of construction. Wisconsin has about 63,000 miles of highways according to government reports, and a population of two million and one-half. Almost four-fifths of these people live in rural districts, necessitating an extensive system of rural highways by which the farming, dairying, and stock raising population of the State can get their products to the railroad and market. The 9-foot road has proved the most economical and practical at the present stage of industrial developments in the State, and this width of roadway will no doubt predominate for some time to come.

In 1914 for the first time State and county aid was given to construction on the connecting streets in villages and cities under 5000. Most of these took advantage of the revised law in both 1914 and for 1915.

Appropriations for 1915 construction are slightly less than for work in 1914, but including balances of probably about $300,000 carried over, and the $3,630,000 appropriated by State, counties and towns construction will amount to $4,000,000 in 1915.

Appropriations for the support of the commission were $40,000 for the fiscal year 1911–12; $60,000 for 1912–13; $90,000 for 1913–14; and $100,000 for 1914–15 and thereafter. There has been an unexpended balance each year. Total supervisory expenditures of the commission to January 1, 1915, were $206,000, construction supervised $8,300,000, giving a supervision cost of 2½ per cent.

The commission has tried to follow the motto "A dollar's worth of road for every dollar of tax." Economy and efficiency have been particularly emphasized, and it has been the practice of these principles which has contributed largely to the success and popularity of the road work in Wisconsin.

A. R. HIRST,
State Highway Engineer.

Wyoming

There is a total of about 15,000 miles of what are known as county roads, and in addition to this there are several thousand miles of roads that have been in use for years, but to which the county pays no attention. The State legislature has designated several routes aggregating about 3000 miles, which are known as State highways, and has provided for the employment of State convicts in the construction of such highways. There are over 1000 miles of road which have been improved by grading and providing drainage. These roads are mostly in the mountainous or hilly districts where the material is largely gravel or shale, so that a hard surface is not provided. The work of locating the State highways has progressed slowly, as the legislature has failed to provide any means for carrying on this work. It is only as the State engineer is able to interest the counties, that this work can be done.

By deputizing the county surveyor and having him paid by the county, nearly a thousand miles of State highways have been located. Of such roads, about 100 miles have been improved by convict labor. The last legislature designated about 600 miles of road as State highways. This is in addition to the 2000 miles laid out by the previous legislature. But few convicts have been available this year for road work, largely on account of construction work at the State penitentiary, where convicts who were eligible for outside work have been employed.

Considerable interest has been aroused in the State, owing to several through routes which have been designated to cross various parts of the State.

A. J. Parshall,
State Engineer.

HIGHWAY IMPROVEMENT IN CANADA

PROVINCE OF QUEBEC

Earth Roads

In the Province of Quebec, local municipalities, according to the municipal code, look after the making and maintenance of roads. This does not mean that all the roads of the municipalities are built and maintained directly by the local council. Practically, it is the contrary that exists. Excepting certain municipalities in the eastern townships, roads in local municipalities are maintained by each land owner, and are subject only to a general supervision by the council (in certain exceptional cases, the county councils build or maintain certain roads).

The government of the Province of Quebec, though anxious to improve the system of road maintenance, has respected the autonomy of local municipalities and has taken no coercive action thereon, but, in order to induce the local municipalities to give up the system of maintenance by the land owner, it has, in 1908, decided to grant an annual subsidy to local municipalities taking at their own charge the maintenance of their roads. Up to date, out of the 1100 municipalities of the Province, 300 or 400 have taken the government's offer.

Macadamized or Gravelled Roads

As far back as 1908, the government has granted subsidies equal to $1000 a year for macadam and $500 a year for gravel, in the proportion of 50 per cent of the amount expended by each municipality. Besides, one-half of the amount expended for the operation of the machinery was paid.

In 1912, without giving up the system of the 50 per cent grant, the government got authorization from the legislature to borrow $10,000,000 and to give to the local municipalities allocations sufficient to cover the whole cost of the work done by them in gravel or in macadam. An authorization to increase this amount will be asked from the legislature during the present session.

Out of the $10,000,000 above mentioned, the government has carried out two plans: *First*—It has allocated, as already said, certain sums to local municipalities for macadamizing or gravelling. *Second*—It has employed a certain part of the $10,000,000 for the building of trunk roads between important centers of the Province.

Most of the gravel and macadamized roads built in the Province of Quebec has been constructed between 1908 and 1915. The work referred to in this paragraph is macadam and gravel roads constructed according to the government's specifications and regularly inspected by it.

Salient Facts

1. The Department of Roads owns 57 complete outfits for the construction of macadam. These outfits are lent or rented to the municipalities.

2. Besides the government's outfits, about 150 outfits are owned by municipalities. They have been paid with the money allotted by the government to those muncipalities out of the $10,000,000 referred to above.

3. From 1908 to data, 910.8 miles of macadam have been constructed under the government's supervision and with its aid; also 416.45 miles have been gravelled under the same conditions.

4. The government has built the King Edward road, about 40 miles, from Montreal to Rouse's Point. This road is in macadam.

It has under construction the Montreal-Quebec road, in macadam, the total length of which is 151 miles. The number of miles finished is about 45.

It has also under construction the Sherbrooke-Derby road, about 32 miles, to be completed next summer, and the Levis-Jackman road, 93 miles, of which 73 miles have been taken by the government. Forty-six miles have been gravelled last summer and the balance will be gravelled next summer.

No aid is given to the Province by the Dominion Government.

B. MICHAUD,
Deputy Minister.

PROVINCE OF ONTARIO

The Province of Ontario is today engaged upon a solution of the one great road problem which confronts its sister provinces and the States of the American Union—namely, increased marketing facilities for the farmer and easy communication between its large centers of population. In spite of the hardships and financial depression resulting from the war being waged in Europe or rather by reason of the handicap upon the enterprise of private corporations, the work of highway construction and improvement promises to assume in the immediate future perhaps the foremost place among public works in this Province. The economic situation is such that among the municipalities which feel most severely the effects of the financial emergency, revenue is being devoted towards highway work of more or less permanent nature to an extent that justifies the application to public works equally with private undertakings of the motto "Business as Usual." Coöperation between the Provincial government and the municipalities has been aided rather than diminished by the economic situation, and public opinion is strongly in favor of carrying out highway proposals set in motion before the events of last August. Important legislation affecting the situation in the older portion of Ontario is expected during the forthcoming session in February–March, but meanwhile the counties are continuing their operations under the amended Highway Improvement Act of 1912 and the preliminary work recommended by the Royal Commission of 1913–1914 is being successfully concluded.

The Public Roads and Highways Commission, appointed July 31, 1913, made its report on March 31, 1914. The commissioners emphasized the importance of coöperation between cities and country districts, the possibilities of motor traction for marketing purposes, and the need of bringing township roads up to an efficient standard for the use of the farmer. It was recommended that the Province should embark in 1915 on a fifteen years' policy with a contemplated capital expenditure on roads of $30,000,000, the remainder of 1914 being used for the purpose of preliminary surveys of the road situation in Ontario, including motor surveys of main travelled roads, an investigation into the needs of township roads and a comprehensive traffic census about market centers. For the purpose of administration and the determination of Provincial aid, the suggestion was made that the highways of the settled portions of Ontario should be re-classified into county and township roads, the latter receiving grants apportioned on bases of assessment, population and area; the former being divided into rural, suburban and interurban roads. The Provincial grant for construction was suggested as 66⅔ per cent for interurban roads, and 40 per cent for rural and suburban roads; while for maintenance it would be 40 per cent for rural and interurban roads and 33⅓ per cent for suburban roads. A local improvement tax would supply the cost of constructing suburban roads in excess of $10,000 a mile, and the determination of areas about cities which include these highways was recommended as part of the new organization's program. To finance this thirty million dollar proposal, the commission advocated the issue of year bonds, and a taxation of motor vehicles on the basis of horsepower and tonnage with a minimum tax of $10 a car. This would realize at the outset $400,000 and would form a substantial part of the revenue for Provincial expenditure on roads. The report *in extenso* has been sent out to the various highway commissioners in the United States and in Canada.

During the summer of 1914, trained engineers were sent out to the various sections of the Province for the purpose of obtaining information concerning present and proposed county road systems, leading township and other market roads and the traffic about centers of population which might lead to the placing of the highways on a basis conformable to actual and potential traffic requirements. Reports based on these findings are now in the course of preparation. The financial side of the undertaking is also under investigation, with a review of assessments and bases of Provincial aid to townships.

Meanwhile government assistance for roads is limited to those counties taking advantage of the Highway Improvement Act which was originally passed in 1901; was consolidated and revised in 1907, has received minor amendments at each subsequent session of the legislature and assumed its present form in 1912.

The main feature of the Act is the creation of county road systems upon which a considerable amount of important highway construction is being carried on by county councils. To this work the Provincial government contributes one-third of the cost, the Act of 1912 having appropriated $2,000,000 for this purpose. (There is at present no highway subsidy from the Dominion Government.)

The general basis of the Act is as follows:

1. A county council is authorized to assume a system of roads for construction and maintenance.
2. A by-law adopting such a system may be passed by a two-thirds majority of a council representing at least one-half of the total equalized assessment of the county.
3. Failing to receive a two-thirds majority of the county council, it may be carried by a simple majority, and a majority vote of the ratepayers.
4. The roads assumed are usually such as will accommodate the greater part of local market travel, creating a system of main market roads. They should be connected as far as practicable to serve the needs of through traffic of the locality. These county systems should not be confused with old county roads, many of which have ceased to be the roads of greatest travel; the trend of traffic is constantly changing through the building of new railroads, and the creation or growth of new local markets and shipping points.
5. The mileage of roads assumed varies, but is usually from 12 to 15 per cent of the total road mileage of a county.
6. The direction and superintendence of the work is placed

in charge of a county engineer or capable superintendent appointed by the county council. A committee of the county council should coöperate with, advise and direct the road superintendent, but no municipal councillor can be employed by the road superintendent in any capacity.

7. The nature of the traffic upon county roads and the width of tires of vehicles using the same may be regulated by by-laws passed by the council of the county having jurisdiction over the road.

8. Roads are to be built in accordance with the regulations of the public works department. The construction should be suited to local circumstances of material and traffic. A standard type is regarded as a roadway well drained, graded to a width of 24 feet between ditches, with broken stone or gravel in the center to a width of from 8 to 15 feet, and consolidated by rolling.

9. The cost varies with local conditions, but is, in general, proportionate to the width and kind of metal.

10. The system of roads assumed, and by-law fixing the plan of improvement, are subject to approval by Order-in-Council. A county council when considering the adoption of a county system or framing their by-law should communicate with the Provincial engineer of highways, in order that their plan may be prepared in accordance with the requirements and objects of the Highway Act.

11. When roads are assumed by a county council under this Act, township councils cease to have control over them, nor should they make any expenditure on them. The county council is thereafter responsible for construction and maintenance.

12. County roads ceasing to be of importance may revert to the township, either by Order-in-Council, or on the declaration of the county council, approved by Order-in-Council and two-thirds of the local municipalities in the county.

13. The Provincial grant is paid annually, and is based on a statement of expenditure for the year, submitted to the minister of public works by the county council, and includes all costs of labor, material, engineering services, salary of road superintendent, machinery, and bridges on the designated system of county roads.

14. The county council may finance their work by issuing debentures to the amount of two per cent of the equalized assessment for a term not exceeding thirty years; or by sums raised from year to year in the annual county rate.

15. The cost of purchasing and reconstructing toll roads may be included in the expenditure.

16. Statute labor along the roads belongs to township councils who may have it worked out on adjoining roads, or may wholly

commute it and spend it on other roads. If the townships so determine, the fund raised by commuting statute labor may be transferred to the county to be used in repairing the county roads or in keeping them open in winter.

17. Provision is made for agreements between city and town councils and the county in question for the contribution by the former of the extra cost of a county road entailed by the traffic requirements of the city or town.

18. The county council may, from time to time make grants to villages and towns, to improve roads which are extensions or connecting links of county roads entering such towns or villages. One-third of grants so made to towns having a population of three thousand or less will be paid by the Province; but in case of towns having a population of more than 1,500 the money must be spent in the suburbs adjoining farm lands. Where the population is 1500 or less, expenditure made on the designated streets is not restricted to suburban sections. The county thus has power to make a grant irrespective of population, but the limitations apply to grants upon which the Provincial grant of one-third is asked.

19. The highway improvement grant extends to the construction of bridges and culverts on county roads, as part of the county road system. There is another class of county bridge, however, comprising bridges of greater length than three hundred feet in township and towns having an equalized assessment of less than $1,000,000. These are to be built by the county according to specifications of the Provincial engineer of highways and are likewise to be maintained by the county, provisions being made for their declaration as county bridges by the judge of the county court.

At present, out of 38 counties and unions of counties in older Ontario, 20 counties are operating under the Highway Improvement Act, the total expenditure on county road systems being $898,631.14 in 1912 as compared with $712,072.52 in 1911 and $553,312.61 in 1910. Expenditure has correspondingly increased every year, so that today county road work is costing approximately $1,000,000 annually, of which the Province pays at the present time one-third. The greater part of this amount has been spent in road construction ($567,948.71 in 1912), a certain portion going towards permanent bridges ($190,617.52 in 1912) and the remainder towards superintendence and equipment, as well as to special county grants to townships, towns and villages. The mileage of road metalled in 1912 included 138.6 miles of crushed stone and 66.5 miles of gravel. The Provincial office of public roads and highways has built annually one or more model roads, those constructed in 1912 being of concrete at $1.336 per square yard and of macadam at $1.023 per square yard.

Engineering assistance, advice, and the preparation of plans and specifications with inspection of work performed are also provided by this office. In order to secure coöperation with the counties and other municipalities for greater uniformity and efficiency of highway work, the Provincial engineer of highways has arranged a course of instructions for county road superintendents and municipal representatives from February 23 to 26, 1915, the subjects covering the various phases of highway and bridge construction and maintenance and systems of cost-keeping, etc.

The Local Improvement Act provides for the building of roads and bridges by municipalities other than counties, the cost to be divided between the corporation and the assessed owners. The latter, who pay a frontage tax, have a right to petition for or against the undertaking of a work by local improvement, but roads and bridges may be constructed without petition on a two-thirds vote of the municipal council. Provision is made for the assessment of the owners' portion of the cost on non-abutting as well as abutting land. Where the estmated cost of constructing a highway or bridge as a local improvement exceeds $50,000, the approval of the Ontario Railway and Municipal Board is required.

Township road management is in the hands of the township council who act as, or appoint overseers. Pathmasters are appointed to superintend the keeping open of roads in winter. Statute labor has largely been commuted throughout the Province, the rate varying from 40 cents to $1.00 per day. By the end of 1912, of 155 townships, 41 had abolished the system, 93 had wholly commuted and 26 had partly commuted their statute labor.

The highway system outlined above will doubtless be affected by future legislation resulting in part from the findings and recommendations of the royal commission of 1913–1914 and the 1915 session of the legislature may be expected to give a great impetus to the highway movement in Ontario. Already the recommendations of the commission have brought about the organization necessary for the building of an important trunk road from Toronto to Hamilton, a distance of 36 miles along the north shore of Lake Ontario. This road, to be constructed of one-course concrete, passes through a very productive fruit-growing country and will serve not only an important motor traffic but also the market-gardeners and farmers of the several towns and villages between the two cities. The undertaking has been delegated by the government to a commission consisting of prominent local men, and work is progressing favorably. An agreement has been reached by which the Province will contribute $4000 per mile, a like amount being paid by the interested municipalities for those parts of the road within the limits of their respective corporations. Toronto is to contribute $150,000 and Hamilton $30,000, the remainder of the cost being provided by a frontage or local improvement tax on abutting and benefitted land, following the method now in use and outlined above. Municipal debentures bearing interest at not less than 5 per cent and payable within twenty years will be guaranteed by the Province and are to be realized by the commission after five years. The total cost of the road will approximate $600,000.

This Toronto-Hamilton road is only part of the proposed 535-mile interprovincial highway from Windsor to Montreal, passing through Windsor, London, Hamilton, Toronto and Kingston. Highway improvement along this route will cost in the neighborhood of ten million dollars. A branch line of 60 miles from Ottawa to Prescott will serve not only as a market road for the agricultural district between the Ottawa and St. Lawrence Rivers but will carry an important tourist traffic between the Canadian capital and the international boundary.

Trunk highways and side-lines in unsurveyed, sparsely settled and unproductive portions of the Province known as colonization roads, are classified according to whether they are financed solely by the government or are designated by the township and aided by the Province to the extent of between two-thirds and one-third of the approved estimated cost. In 1913, the mileage of roads constructed was 844, costing $306,391.02 towards which the municipalities contributed $144,868.32. In New Ontario, trunk roads are constructed by the Northern Development Branch, the total mileage for the season of 1912 being 233 miles along the colonization railways, costing $193,082.80; and 764 miles in 1913 north and northeast of Lake Superior, costing $1,081,172.28.

It may be noted that the motor fees of the Province have recently been placed upon a horse-power basis, instead of the old flat rate of $4 per license. Up to 25 horse power (fixed according to the A.L.A.M. formula) the fee is $6; from 25 to 35 horse power, $10; from 35 to 50 horse power, $15; and over 50 horse power, $20. Under the present system, motor fees are collected by the Provincial secretary and form part of the consolidated revenue of the Province. This new motor tax will produce at the outset a revenue of $200,000 annually.

W. A. McLEAN,
Provincial Highway Engineer.

NOVA SCOTIA

During the season of 1914, over $600,000 was spent on roads in Nova Scotia, the Province being assisted by a grant from the Dominion government pro-rated among the counties on the basis of importance of location, need of roads, and kind of traffic. Nova Scotia is the only Province in Canada which devotes its revenue from motor vehicle fees to the exclusive use of roads. From this source $13,000 was received in 1914 and with other revenue was expended chiefly on the improvement of earth and sand-clay roads.

W. A. McLean,
Provincial Highway Engineer of Ontario.

BRITISH COLUMBIA

The government of British Columbia takes charge of main trunk roads in many municipalities and grants aid in certain cases to urban municipalities. During the fiscal year 1913–1914, the expenditure on roads, streets, bridges and wharves amounted to $5,117,180.92, with the construction of 1230 miles of roads. The chief trunk roads now being built are the Pacific highway (to the international boundary), the Kingsway (between Vancouver and New Westminster), the Banff-Windermere road built with the coöperation of the Canadian Pacific Railway), and the Hope-Princeton road.

W. A. McLean,
Provincial Highway Engineer of Ontario.

SASKATCHEWAN

Highway and bridge appropriations to be expended under the direction of the board of highway commissioners of Saskatchewan amounted to $2,117,000 for 1913 and $2,090,000 for 1914. Of these amounts, the votes for public highways chargeable to capital account were for each of the two years $1,200,000. During the season of 1914, expenditure under this vote amounted to $1,002,685.84, part being spent directly by the Province on road improvement, and part by the muncipalities under the regulations of the commissioners. The total spent upon steel bridge and concrete abutments for 1913–1914 was $337,483.18. As highway work in Saskatchewan must be mainly of a pioneer nature, the chief concern of the government is to provide setlers with good dirt roads to the nearest market towns, with a view as well to connecting up the centers of population; metalled road construction has not yet been undertaken. Money grants to municipalities was discontinued in 1914, but government crews were loaned instead. Road drag competitions are also instituted by the government.

W. A. McLean,
Provincial Highway Engineer of Ontario.

STATE FUNDS AVAILABLE FOR 1915 ROAD WORK

In this chapter are given detailed reports showing State funds available for 1915 in each State. Many of the reports also give local funds available and give details as to 1914 expenditures. For a condensed statement of State funds available and for local expenditures during 1914 see tables at the end of this chapter. The value of statute labor tax for 1915 will probably aggregate about $12,500,000 and the value of convict labor on roads may be roughly approximated at $3,000,000. If the local expenditures for 1915 increase 10 per cent as compared with 1914 expenditures, the total outlay in money and labor for 1915 will be as follows:

State funds	$56,243,107
Local funds	183,077,000
Estimated value labor tax	12,500,000
Estimated value convict labor	3,000,000
Total outlay	$254,820,107

Alabama

From all counties for construction and maintenance of roads and bridges (approximately), $1,500,000; from State in State aid work for 1915, $154,644.71; from State in State aid work for 1914 unexpended, $40,880.34; total $1,695,525.05.

Bonds and warrants 1914, proceeds not yet expended; bonds: Etowah County, $200,000; Walker County, $250,000; Lamar County, $75,000; Lowndes County, $153,000; total $678,000.

Interest bearing warrants: Bibb County, $30,000; Chilton County, $25,000; Shelby County, $40,000; Franklin County, $10,000; Fayette County, $25,000; total $130,000.

W. S. Keller,
State Highway Engineer.

Arizona

For the fiscal year 1914–15 the following amounts are available for State and county construction and maintenance: State highway department, $396,883.19; counties, $575,000; total $971,883.19.

E. P. Adams,
Chief Clerk.

Arkansas

Approximate funds available for 1915: automobile licenses and fees from sale of State lands, $37,500; from 3 mill tax (to be spent by counties) $1,300,000; total $1,337,500.

H. R. Carter,
State Highway Engineer.

California

The sum of $6,921,931.67, of the total $18,000,000 bond issue provided by the State for a highway system, was expended to September 15, 1914, and of this amount expenditures in the year 1914 totaled $4,333,079.72. Receipts from the motor vehicle licenses imposed by the State were $1,350,000 gross; half of this goes to the State for maintenance and half to the respective counties from which payments are made, after deduction of the expenses necessary for license tax and collection.

No record was kept of expenditures by counties and townships for road purposes in 1914.

A. B. Fletcher,
Highway Engineer.

Colorado

The funds available for expenditures by this department will amount to about $300,000 for this year, as near as we can estimate at this time.

In meeting this amount the counties will put up probably about $200,000. This amount will be spent on the State primary road system. In addition to this, the counties will raise by their tax levy for roads and bridges about $1,250,000 which will be spent on all roads other than State roads, or a total of $1,750,000, although it is possible that about $250,000 of this latter amount may be diverted to use upon the State road systems. The sources of the State fund are as follows: Amount repaid from capitol building fund, $165,000; receipts from automobile license, $35,000; amount received from the internal improvement income and permanent fund, $100,000; total $300,000. The county fund is raised entirely by direct levy for roads and bridge purposes.

J. E. Maloney,
Secretary and Engineer.

Connecticut

The legislature of 1913 made an appropriation of $3,000,000 for road work, $2,000,000 of which was designated as trunk line fund and $1,000,000 as State aid fund. These appropriations run to September 30, 1915.

The appropriations for repairs on State aid roads and for administration purposes are the same as last year's appropriation, (about $400,000). The receipts from automobile licenses will aggregate about $400,000 a year.

The State continues to pay three-quarters of the cost of State aid roads in towns with a grand list of over $1,250,000 and seven-eighths of the cost in towns having a grand list of said amount or less. The State also pays three-quarters of the expense of maintenance of State aid roads and the entire expense of the maintenance of trunk line highways.

C. G. Nichols,
Chief Clerk, State Highway Commission.

Note: The above items make an indicated annual outlay of about $2,300,000 on State work.

Delaware

New Castle County, 1915: State fund, $10,000; county fund, $50,000; total $60,000. The general assembly meets in January 1915 and may authorize a bond issue.

J. Harry Pierson,
Assistant to the Highway Commissioner.

Note: Other counties' funds available not reported.

Florida

No State funds appropriated.

Georgia

No State funds appropriated.

Idaho

Total amount of money expended during the year 1914, for highway work:

For State Highways

By State, $56,360; by counties, $53,000; total $109,360.

For County Roads

By counties and highway districts (est.) $1,000,000. The amount available for 1915 is approximately as follows:

State Funds

Balance on hand, motor vehicle tax, $25,000; balance on hand, State highway bond issue, $175,000; 1915 motor vehicle tax (estimated), $50,000; total $250,000.

County funds to be expended under direction of State highway department, $350,000; estimated county and highway district expenditure other than above, $750,000; grand total, $1,350,000.

EDW. S. SMITH,
State Highway Engineer.

Illinois

From the appropriation of the last session of the legislature, there yet remains to be expended for State aid road construction in this calendar year about $1,000,000.

In addition to the foregoing, there will be about $300,000 available this year for what we call township or experimental road construction. For the biennium beginning July 1, 1915, we have asked the legislature for an appropriation of $2,500,000 for State aid road construction, which amount would be met with another $2,500,000 by the counties making $5,000,000 available for State aid road construction during the two year period from July 1, 1915, until July 1, 1917.

W. W. MARR,
Chief State Highway Engineer.

Indiana

Township gravel road bonds outstanding January 1, 1914, $30,950,587.94. The statistics are not complete for 1914, but those for 1912 show that the taxpayers paid out for roads in one form or another in 1912, as follows: Gravel road bonds and interest, $3,876,881.43; paid for new roads, $5,611,403.28; expended on bridges and bridge repairs, $1,429,918.33; expended on gravel road repairs, $1,802,925.33; paid reviewers, $33,326.98; total $12,754,455.35.

Amount expended by townships: road tax worked out, $1,832,407.58; road tax paid in cash, $445,356.46; grand total $15,032,228.39.

From State Statistician's report.

NOTE: No data available to estimate 1915 expenditures which must therefore be approximated from the above figures.

Iowa

Estimated amount of money available for road improvement during 1915, including culverts and bridges: State appropriation for highway commission, $80,000; auto tax distributed by the State, $920,000; township road fund controlled by township trustees, $3,000,000; township drag fund controlled by township trustees, $500,000; county road fund controlled by county supervisors $3,000,000; county bridge fund controlled by county supervisors, $3,500,000; total $11,000,000.

The above are all cash taxes. There is in addition roughly $500,000 available from labor taxes.

THOS. H. MACDONALD,
Highway Engineer.

Kansas

Township and county funds available for roads and bridges in 1915, about $5,810,830.

Automobile and motor-cycle registration fees, about $200,000.

For State highway work, about $9,500; total $6,020,330.

W. S. GEARHART,
State Engineer.

Kentucky

Total appropriation for State Highway Department for 1914 was $25,000. The total appropriation for 1915 is $25,000, but only such part to be used as is necessary in carrying on the work of the Department, which is purely advisory. Estimated money to be spent by the various counties and State on the public roads during 1915 $2,900,000.

ROBERT C. TERRELL,
Commissioner of Public Roads.

Louisiana

Total expenditures for State aid roads up to December 31, 1911, $43,321.51; to December 31, 1912, $169,986.42; to December 31, 1913, $224,985.62; to December 31, 1914, $319,949.89. Total expenditures for State aid roads up to December 31, 1914: State funds, $280,186.68; parish funds, $478,056.76; total, $758,243.44.

These amounts are supplemented by labor of State convicts, surplus revenues of the oyster commission and automobile revenues. The cost of State aid roads is apportioned 20 to 50 per cent to the State and 50 to 80 per cent to the parish (county).

Estimated parish expenditures for 1914, $3,000,000; estimated expenditures by incorporated places $2,000,000; State highway department contracts let during 1914, $400,000; State convict camps 1912, $32,220.

CHAS. F. WOOD,
Secretary, Highway Department, Board of State Engineers.

NOTE: Estimated that $145,000 State funds will be available for 1915.

Maine

During the year 1915 there will be available for expenditure for the State highway commission the following sums:

State aid highway Bonds to be issued in 1915..		$500,000
State aid appropriations	$300,000	
From cities and towns for same purpose, about	300,000	
State aid highways		600,000
Administration and maintenance.		
State appropriation 1915	50,000	
Residue from automobile license fees after payment of interest and sinking funds on bonds (estimated) 1915	125,000	
Payments by towns on account of maintenance State aid highways already built (estimated)	25,000	
Balance of State appropriation 1914	8,000	
		$208,000
Special resolves by legislature		100,000
Total appropriation to be handled by State highway commission, 1915		$1,408,000

PAUL D. SARGENT,
Chief Engineer.

Maryland

State funds available $4,572,000. Estimate by U. S. Office of Public Roads.

Massachusetts

The average yearly appropriation by the cities and towns in Massachusetts for highways and bridges was $8,232,490. The cities and towns have also an excise and franchise tax available from the street railway companies amounting to $1,327,191, making a total of $9,559,681. These figures were collected for the year 1913 and will be approximately the same in 1914 and 1915.

The above expenditures were those made by the cities and towns but did not include the expenditures of the State for State highways, State aid roads, etc.

The State Highway Commission expended in 1914 for new construction, including State highways and "small town" work and the work done with money obtainable from the motor vehicle fees $1,227,980.

We had available for construction under special acts of the legislature $261,567, and for one investigation about $40, making a total of $1,489,587 expended for construction.

We expended for the maintenance of highways, bridges, etc., $903,903; for general office expenses, salaries of commissioners, etc., $70,876. The automobile department which has to investigate automobile accidents, care for the registration of cars and the issuing of number plates, etc., expended $156,603, making the total expenditure of our department $2,620,965. The total expenditures by the cities and towns and the State amounted to about $12,000,000.

In 1915 the State highway department has available from the loan fund for State highway work and "small town" work, $1,000,000; also it has available for work in the towns under the Motor Vehicle Fees Act about $150,000, and for the maintenance of bridges, $17,000; for the repair and maintenance of State highways from the tax levy, probably $350,000 would be available, and from the motor vehicle fee fund about $600,000 will probably be available for the maintenance of State highways. We have also available from certain special acts of the Legislature requiring the construction of particular roads, something over $200,000, making a total to be expended by this department of $2,317,000.

There are a large number of propositions relating to particular roads now pending before the legislature, some of which may become a law and additional appropriations may be made for the purpose of constructing particular roads.

Wm. D. Sohier,
Chairman, Massachusetts Highway Commission.

Michigan

There were appropriated by the last legislature $300,000 for the fiscal year ending July 1, 1915, to be used in connection with the automobile license fees of the State. Owing to the fact that the act turning the automobile license money over to this department for use in road work, was declared unconstitutional by the supreme court, the department was deprived of some $800,000 of reward money.

For the fiscal year ending June 30, 1914, the department paid out $581,736 in State reward upon roads. It is estimated that about $4,000,000 will be raised for road purposes by townships and counties from bonds and direct taxation.

Frank F. Rogers,
State Highway Commissioner.

Minnesota

Total levies by county board for 1915	$2,323,864.01
Probable State road and bridge fund for 1915 about	1,600,000.00
	$3,923,864.01

George W. Cooley,
State Engineer.

Mississippi

No State funds appropriated.

Missouri

Approximately $400,000 available. Estimate by U. S. Office of Public Roads.

Montana

Approximately $30,000 available. Estimate by U. S. Office of Public Roads.

Nebraska

A State tax of one-fifth of 1 mill is levied to create a State aid bridge fund, which for 1915 amounts approximately to $90,000.

I am not in shape to advise you the different amounts of money that the counties and township organizations will raise.

D. D. PRICE,
State Engineer.

Nevada

No State appropriation yet made for 1915.

New Hampshire

The total expenditures for State aid up to January 1, 1915, has been $2,428,808.59. The State's portion for the year ending January 1, 1915, was trunk line roads $187,061.76; for State aid roads $69,998.72; for State roads $10,122.09. There was expended for maintenance $157,155.38 during the same period by the State.

S. PERCY HOOKER,
State Superintendent of Highways.

NOTE: U. S. Office of Public Roads estimates 1915 State fund available $400,000.

New Jersey

No report from highway department. Estimate by U. S. Office of Public Roads, $1,360,000.

New Mexico

To Be Spent by Highway Commission

Mill levy, $81,000; delinquent State taxes, $8,019; auto license, $21,000; forest reserve (Grant and Socorro counties) $6,231; special roads (county levy), $58,750; total $175,000.

To Be Spent by Counties

General road fund, $167,595; delinquent taxes, $18,335; Camino real, $16,615; forest reserve, $10,640; Dona Ana County bond issue, $50,000; three-dollar road tax, $50,000; special bridges. $57,815; total $371,000.

Total of State and county funds, $546,000.

Of this amount $57,815 must be used in paying for bridges built or now under contract already made. Leaving $488,185 available for new road work.

JAMES A. FRENCH,
State Engineer.

New York

No appropriation has been made by the legislature at this date from the highway improvement fund for highway construction in 1915. This department has asked for an appropriation of $10,000,000 for that purpose. All previous appropriations are entirely obligated by existing contracts. The first referendum, or fifty million bond issue, has been either expended on completed contracts, or is obligated by existing contracts. Any appropriation made by the legislature for future construction will have to be made from the second referendum, or fifty million bond issue.

There will be available for construction and maintenance and repair of what are called town roads, in distinction from improved roads (improved roads being those which have been constructed either wholly or in part from the highway improvement fund), approximately $5,000,000 as follows:

$1,925,000, appropriated by the State for roads exclusive of Indian reservations;

$75,000, appropriated by the State for roads and bridges within Indian reservations;

$3,000,000, appropriated by towns for roads exclusive of Indian reservations.

This amount of $5,000,000 is not expended by the department, but under the supervision of the bureau of town highways, which is a bureau of this department.

No appropriation has been made by the legislature at this time for the maintenance and repair of improved roads during 1914, improved roads meaning roads which have been constructed either wholly or in part by the State from the highway improvement fund, but in all probability this appropriation will approximate $5,000,000.

S. D. GILBERT,
Auditor.

North Carolina

An appropriation of $5000 is made for educational highway work of State geological survey.

NOTE.—The 1915 legislature has just passed a bill establishing a Highway Department and appropriated $10,000 for its use.

North Dakota

I am of the opinion that approximately $725,000 will be collected by the various counties of the State as taxes for the road and bridge fund. There will be paid into the county treasuries in the neighborhood of $400,000 in the way of delinquent taxes, in addition to the amount mentioned. There will be approximately $45,000 returned to the various counties from the motor vehicle registration account. There are no funds to be expended under the direction of this office for road purposes.

It is difficult to estimate the amount of money that will be expended in the various townships during the ensuing year, because of the fact that there are no past records to go by. I estimate however, that at least $1,200,000 worth of township taxes will be worked out in the various townships in the State. This is in addition to the estimates given in the previous paragraph.

Practically the entire amount of money raised during the year for road purposes will be expended in 1915, therefore the total amount of money expended on North Dakota roads in the year 1915 is approximately $2,370,000.

JAY W. BLISS,
State Engineer.

Ohio

The appropriations for 1915 have not been made but in all probability will be as follows:

The receipts from the automobile license fund will no doubt be appropriated for maintenance and repair and will be approximately $650,000 to $700,000; for construction of inter-county highways, approximately $1,500,000; for main market roads, approximately $500,000.

JAMES R. MARKER,
State Highway Commissioner.

Oklahoma

Automobile revenues of approximately $15,000 for State highway department.

Oregon

State funds spent 1914, $225,000; State funds available 1915, $240,000; county road fund available 1915, $4,200,000.

During the five years ending October 1, 1914, the county courts had expended $15,511,824.77.

H. L. Bowlby,
State Highway Engineer.

Pennsylvania

The following is a statement of available funds and expenditures, January 1, 1914, to January 1, 1915.

Available funds year 1914	$4,994,660.04

Expenditures, January 1, 1914, to January 1, 1915

Payment on contracts:			
State aid roads	$1,342,323.00		
State highway routes	494,420.90		
Signs and sign posts	13,257.00	$1,850,000.90	
Advertising contracts		4,990.75	
Surveying and inspection, road contracts		131,653.52	
Surveying and plotting, State highway routes		16,103.36	
Surveying and plotting, county maps		33,357.10	
Maintenance Expenditures			
State highway routes	$1,344,780.48		
State aid roads	343,726.22	1,688,506.70	
Machinery, tools and equipment		45,803.95	
Toll road purchase		79,393.38	
Damages on account of change of line		498.00	
Bonus distributed to townships		200,000.00	
Auto license division, cost of postage, salaries and expenses		81,700.10	
Undistributed expenses, department salaries, field office, etc.		304,357.86	
Total expenditures, year 1914			**4,436,365.62**
Balance available funds, January 1, 1915			**$558,294.42**

S. D. Foster,
Chief Engineer.

Note: No estimate obtained of funds for 1915.

Rhode Island

Total expenditures on trunk lines for construction to December 31, 1914, $2,620,784.40. For reconstruction, resurfacing and repairs from 1905 to December 31, 1914, $1,049,451.76.

Do not expect any appropriation for construction this year. State expenditure 1914 for maintenance, $166,169.35.

The State board of public roads, asked the legislature for an appropriation of $400,000 for maintenance and reconstruction.

The income from the automobile law will be about $165,000 this year.

All the towns of this State appropriate for their highways about $390,000 collectively each year.

PETER J. LANNON,
Clerk.

South Carolina

The counties in this State spend annually a sum aggregating just about $1,000,000 for road work, and we use convicts entirely in the construction of highways. Under our present law even life term men can be used on the highways when they are not considered dangerous by the authorities.

E. J. WATSON,
Commissioner of Agriculture.

South Dakota

Total levy for roads made by counties, $579,948; auto licenses for over 21,000 autos in the State for 1914, approximately $125,000; levy by the township supervisors of all townships of the State estimated $524,052; total to be expended in 1915, $1,224,000.

This total represents about what will be expended in 1915 for road building only, and does not include the $716,533 levied for bridge purposes. Some of the above license money from autos was expended this year—but that will be more than replaced by the license fund of 1915.

E. C. ISSENHUTH,
Chairman, State Highway Commission.

Tennessee

No State funds available.

Texas

No State funds available.

Utah

There has been expended under the direction of the State road commission from December 1, 1913, to December 1, 1914 about $475,000. This sum is made up of the State and county appropriation for the year 1914, most of the 1913 State road tax. and some of the 1914 State road tax. Unless the present law is repealed by the incoming legislature, there will be available for the year 1915 from direct State appropriation the sum of $97,200. Assuming that each of the counties in the State will participate in this fund, there will be appropriated from the various counties, the sum of $62,100. In addition to these funds, there is unexpended about $172,000 collected during the year 1914 as State road tax. In addition to these sums, there is a strong sentiment favoring a substantial special appropriation for the construction of bridges and highways where the property in the vicinity of the highways is not sufficient to justify waiting for the special State road tax for their development.

E. R. MORGAN,
State Road Engineer.

Vermont

State appropriations for 1915, $200,000; voted by towns to get State aid (estimated), $125,000; five per cent tax apportionment, $120,000; total $445,000.

We may easily say, in round numbers, that the road expenditures for 1915 (construction) will be $450,000.

For maintenance of the State roads only, there will be expended by the State an estimate of $140,000; expended by the towns, a minimum, $140,000; total $280,000.

M. SHEED,
Clerk, State Highway Commission.

Virginia

The State has contributed to road and bridge construction in the various counties of the State, approximately one-half million dollars, which, together with county and district bond issues, will make a total for the year of $1,767,010.10 expended in the construction of 855 miles of road and 91 bridges.

GEORGE P. COLEMAN,
State Highway Commissioner.

NOTE: The State appropriates about $185,000 as cash State aid; about $145,000 for maintenance of State convict force; and will derive about $120,000 from automobile fees, or a total of $450,000.

Washington

Amount available for biennium ending March 31, 1915, $3,264,091.37 of which $1,860,045.01 had been expended to September 30, 1914, leaving a balance available of $1,404,046.36. The amount available is made up of State aid balance from levies of 1907–08–09–10 plus the permanent highways levy of 1911–12–13. The permanent highway fund is raised by a tax on all property of 1½ mills.

From State Highway Commissioner's report for 1912–14.

Note: In a telegram to the U. S. Office of Public Roads, Commissioner Roy states that the legislature has just appropriated for the biennum beginning April 1, 1915, $2,152,288 and reappropriated $153,640 for construction and maintenance of State highways, and $4,000,000 for construction and maintenance of other permanent highways; also that $4,000,000 will be expended from county funds for roads and bridges which does not include incorporated cities and towns.

West Virginia

We will expend approximately in this State on road $2,500,000 for 1915 and expended $2,268,557.92 in 1914.

A. D. Williams,
Chief Road Engineer.

Note: No State aid. Annual expense to State of road bureau about $15,000.

Wisconsin

State funds available 1915, $1,250,000 for State aid and $100,000 for administration.

State expenditures 1914, $1,230,000; local expenditures 1914 for State aid construction $3,100,000; for maintenance of roads and bridges $4,500,000 in the 1600 units of government affected by the State aid law.

A. R. Hirst,
State Highway Engineer.

Wyoming

The only State appropriation for road work was that made by the last legislature, amounting to $7500 for the purchase of tools and equipment necessary in using convicts on State highways. It is estimated that the counties of the State will spend $400,000 during 1915.

A. J. Parshall,
State Engineer.

APPROXIMATE STATE HIGHWAY FUNDS AVAILABLE FOR 1915

(RECAPITULATION)

Alabama	$195,524
Arizona	396,883
Arkansas	37,500
California	7,000,000
Colorado	300,000
Connecticut	2,300,000
Delaware	30,000
Idaho	250,000
Illinois	2,500,000
Iowa	1,000,000
Kansas	9,500
Kentucky	25,000
Louisiana	145,000
Maine	1,083,000
Maryland	4,572,000
Massachusetts	2,317,000
Michigan	300,000*
Minnesota	1,600,000
Missouri	400,000
Montana	30,000
Nebraska	90,000
New Hampshire	400,000
New Jersey	1,360,000
New Mexico	175,000
New York	17,000,000
North Carolina	10,000
Ohio	2,700,000
Oklahoma	15,000
Oregon	240,000
Pennsylvania	5,000,000†
Rhode Island	565,000
Utah	269,200
Vermont	460,000
Virginia	450,000
Washington	1,650,000‡
West Virginia	15,000
Wisconsin	1,350,000
Wyoming	7,500
Total	$56,248,107

*Motor vehicle law was declared unconstitutional, so motor fees estimated at $800,000 are omitted.

†Estimate based on 1914 expenditures.

‡Estimate based upon appropriation made for biennium ending March 31, 1915.

CASH ROAD AND BRIDGE EXPENDITURES, EXCLUSIVE OF STATE FUNDS ON PUBLIC ROADS OUTSIDE OF INCORPORATED CITIES, TOWNS AND VILLAGES

1914

Alabama	$2,716,898†
Arizona	603,608
Arkansas	1,750,000*
California	9,495.281
Colorado	1,907,801
Connecticut	1,400,000*
Delaware	270,451
Florida	3,450,000*
Georgia	2,500,000
Idaho	1,114,394†
Illinois	7,500,000*
Indiana	9,000,000*
Iowa	11,363,000
Kansas	5,541,057
Kentucky	1,700.000
Louisiana	2,600,000†
Maine	1,500,000*
Maryland	2,000,000
Massachusetts	3,318,742
Michigan	7,715,000
Minnesota	4,560,000
Mississippi	2,850,000*
Missouri	6,000,000*
Montana	4,089,739
Nebraska	3,347,062
Nevada	200,000*
New Hampshire	1,250,000*
New Jersey	3,500,000*
New Mexico	371,196
New York	6,958,880
North Carolina	3,736,000
North Dakota	1,129,777
Ohio	8.500,000*
Oklahoma	3,375,000
Oregon	3,580,087
Pennsylvania	6,000,000
Rhode Island	385,000
South Carolina	1,000,000
South Dakota	1,421,501
Tennessee	2,500,000*
Texas	8,750,000*
Utah	750,000*
Vermont	750,000*
Virginia	2,465,855
Washington	4,500,000*
West Virginia	2,500,000*
Wisconsin	5,000,000*
Wyoming	426,448
Total	$167,342,777

*Approximate

†For the year 1913.

NOTE. Above statistics obtained from U. S. Office of Public Roads.

PATENTS ISSUED BY UNITED STATES PATENT OFFICE IN 1914 PERTAINING TO ROADS

1,083,310. *Chuck for rock drills.* J. C. H. Vaught. Patented January 6, 1914.

1,083,548. *Corrugated culvert pipe.* C. E. Martin. Patented January 6, 1914.

1,083,555. *Traction engine.* Samuel Murta. Patented January 6, 1914.

1,083,666. *Rotary Rock Cutter.* J. W. Cook and G. A. Waldeck. Patented January 6, 1914.

1,083,897. *Excavator and conveyor.* J. M. Lee. Patented January 6, 1914.

1,084,058. *Brick.* J. G. Barbour. Patented January 13, 1914.

1,084,152. *Dust remover for rock drills.* V. P. Kessel and A. Jorgensen. Patented January 13, 1914.

1,084,183. *Rotating means for rock drills.* D. S. Waugh for Denver Rock Drill Manufacturing Co. Patented January 13, 1914.

1,084,359. *Nozzle for oil-distributers.* H. K. Potter. Patented January 13, 1914.

1,084,534. *Road scraper and grader.* Ami Carver. Patented January 13, 1914.

1,084,810. *Road surfacing machine.* V. V. Messer and A. F. George. Patented January 20, 1914.

1,085,275. *Expansion joint cushion.* W. R. Lonsdale. Patented January 27, 1914.

1,085,467. *Post-collar for rock-drills.* Richard Nettell. Patented January 27, 1914.

1,085,505. *Tamper.* F. A. Stafford. Patented January 27, 1914.

1,085,609. *Automatic irrigator.* H. C. Heath. Patented February 3, 1914.

1,085,667. *Asphaltic Roadway.* E. M. Chadbourne. Patented February 3, 1914.

1,085,737. *Drag attachment.* J. A. Janus. Patented February 3, 1914.

1,085,977. *Method of treating Portland and similar cement.* H. J. Force. Patented February 3, 1914.

1,086,298. *Snow-plow.* W. H. James and M. E. Booth. Patented February 3, 1914.

1,086,304. *Excavating machine.* C. E. Negley. Patented February 3, 1914.

1,086,343. *Form work for concrete construction.* Robert Anderson for Ferro Concrete Construction Co. Patented February 10, 1914.

1,086,501. *Road drag.* D. W. Anderson. Patented February 10, 1914.

1,086,554. *Road grading machine.* James H. and Robert G. Osten. Patented February 10, 1914.

1,086,585. *Land grader.* C. E. Bunker, Jr. Patented February 10, 1914.

1,086,625. *Pneumatic rock drill.* C. J. Smith. Patented February 10, 1914.

1,086,740. *Road scraper.* Henry Warren. Patented February 10, 1914.

1,086,758. *Metallic guard for concrete curbing and the like.* C. W. Denny for Clip Bar Manufacturing Co. Patented February 10, 1914.

1,086,777. *Concrete mixer.* Henry Q. Maurino. Patented February 10, 1914.

1,086,795. *Asphaltic apparatus.* William P. Tarrant. Patented February 10, 1914.

1,086,796. *Pouring pot.* W. P. Tarrant for Tarrant Manufacturing Co. Patented February 10, 1914.

1,087,085. Process of manufacturing asphaltic paving material. Charles N. Forrest for Barber Asphalt Paving Co. Patented February 10, 1914.

1,087,204. Gyratory rock crusher. Ajay Washburne. Patented February 17, 1914.

1,087,632. Rock drilling machine. W. S. Benjamin. February 17, 1914.

1,087,706. Rock drilling machine. Franz Bade. Patented February 17, 1914.

1,088,334. Rock drill. Hans Edgar. Patented February 24, 1914.

1,088,414. Road scraper. Ward Gruner. Patented February 24, 1914.

1,088,509. Road roller. Kazimiers Zawadzinski. Patented February 24, 1914.

1,088,692. Process for the manufacture of asphalt from crude mineral oil or residuum thereof. C. B. Forward. Patented March 3, 1914.

1,088,984. Rock drilling machine. Charles C. Hansen, assignor to Ingersoll-Rand Co. Patented March 3, 1914.

1,089,145. Road surfacing machine. T. J. McDonald for American Car Sprinkler Co. Patented March 3, 1914.

1,089,182. Paving apparatus. R. D. Baker. Patented March 3, 1914.

1,089,356. Asphalt chopping machine. C. E. Bathrick for F. C. Austin. Patented March 3, 1914.

1,089,380. Sidewalk. C. C. McDonald. Patented March 3, 1914.

1,089,427. Road machine. Oakman A. Moody. Patented March 10, 1914.

1,089,488. Process of building reinforced concrete arches. Daniel B. Luten. Patented March 10, 1914.

1.089,613. Metallic surfacing. J. F. Wixom. Patented March 10, 1914.

1,089,883. Concrete machine. Edward N. Trump for Solvay Process Co. Patented March 10, 1914.

1,089,930. Rock Drill. C. H. Locher. Patented March 10, 1914.

1,089,943. Expansion joint. S. T. Morse and W. D. P. Warren. Patented March 10, 1914.

1,090,081. Process of bridge construction. Daniel B. Luten. Patented March 10, 1914.

1,090,084. Paving material. J. S. E. Pardee. Patented March 10, 1914.

1,090,206. Drier for portable asphalt machines. Charles E. Guelich. Patented March 17, 1914.

1,090,229. Apparatus for laying and moulding concrete roadways, pavements and the like. E. L. Ransome. Patented March 17, 1914.

1,090,366. Manufacture of artificial marble. Otto Ernst Heuschkel. Patented April 21, 1914.

1,090,486. Anchoring device for use in connection with concrete structures. Alfred P. Lohmann. Patented March 17, 1914.

1,090,488. Concrete wall mold. George Miller for Miller Concrete Form Co. Patented March 17, 1914.

1,090,676. Valve. Lewis A. Bellis. Patented March 17, 1914.

1,090,701. Concrete fence post mould. Gustav H. Fenske. Patented March 17, 1914.

1,090,718. Reinforced concrete construction. Charles J. Hyer. Patented March 17, 1914.

1,090,792. Process of manufacturing and laying bituminous sheet pavements and materials therefor. Clifford Richardson for Barber Asphalt Paving Co. Patented March 17, 1914.

1,091,147. Concrete building construction. John Arvid Kuivala. Patented March 24, 1914.

1,091,168. Socket for concrete building constructions. John A. Sanquist. Patented March 24, 1914.

1,091,218. Reinforcement system for concrete columns. Rudolph B. Hartman. Patented March 24, 1914.

1,091,264. *Concrete mixer*. Ernest F. Wege, assignor to Sterling Machinery Co. Patented March 24, 1914.

1,091,777. *Road making material*. George Sprung. Patented March 31, 1914.

1,091,952. *Spraying machine*. R. F. North. Patented March 31, 1914.

1,092,169. *Road ditching machine*. James Rannel. Patented April 7, 1914.

1,092,280. *Road smoother*. Eugene McKean. Patented April 7, 1914.

1,092,558. *Sectional highway construction*. Herbert P. Beecher. Patented April 7, 1914.

1,092,676. *Road scraper and smoother*. George E. Tucker, for Ebenezer Robinson. Patented April 7, 1914.

1,092,848. *Joint plate*. Albert Moyer. Patented April 14, 1914.

1,092,865. *Spraying device*. Max Schneider and Clara G. Schneider. Patented April 14, 1914.

1,092,886. *Rock Drill*. C. E. Youmans. Patented April 14, 1914.

1,092,933. *Waterproof concrete and process of making the same*. Richard K. Meade. Patented April 14, 1914.

1,093,098. *Process for treating crude oil*. William S. Barnickle. Patented April 14, 1914

1,093,120. *Rock drill*. Dudley T. Fisher, assignor to Jeffrey Mfg. Co. Patented April 14, 1914.

1,093,202. *Bridge*. C. E. Paine, assignor of one-fourth to Luther Johns. Patented April 14, 1914.

1,093,737. *Tank Car*. Abram E. Smith. Patented April 21, 1914.

1,093,738. *Pavement*. Louis P. Smith and James H. Heaverside. Patented April 21, 1914.

1,093,814. *Road drag and grader*. Bennie Whittemore. Patented April 21, 1914.

1,093,818. *Road oiling vehicle*. George I. Worley assignor of one-half to Charles F. Dehner. Patented April 21, 1914.

1,094,111. *Apparatus for distributing concrete*. Rufus McC. Beanfield. Patented April 21, 1914.

1,094,183. *Floor*. Leslie L. Wright. Patented April 21, 1914.

1,094,313. *Road drag*. Perry C. Dowell. Patented April 21, 1914.

1,095,710. *Spraying apparatus*. B. F. Cranwell. Patented May 5, 1914.

1,096,047. *Core for making concrete culverts*. George Miller, assignor to Miller Concrete Form Co. Patented May 12, 1914.

1,096,183. *Bridge*. William E. Moore. Patented May 12, 1914.

1,096,222. *Wagon track*. S. L. Casselman. Patented May 12, 1914.

1,096,267. *Paving block*. Albert V. Sammis. Patented May 12, 1914.

1,096,348. *Bridge Construction*. Henry Percy Borden. Patented May 12, 1914.

1,096,445. *Concrete tamper*. Claude L. McKesson. Patented May 12, 1914.

1,096,465. *Process of introducing water-insoluble oils into emulsions or water-soluble bodies*. John Henry Smith. Patented May 12, 1914.

1,097,090. *Oil spraying apparatus*. Granville H. Gray, assignor of one-half to Francis W. Steddom. Patented May 19, 1914.

1,097,091. *Apparatus for spraying oil on roads*. Granville H. Gray, assignor of one-half to Francis W. Steddom. Patented May 19, 1914.

1,097,234. *Collapsible concrete culvert form*. John W. Kempf. Patented May 19, 1914.

1,098,200. *Road grading machine*. Herman Whitney and Elmer Whitney. Patented May 26, 1914.

1,098,433. *Pavement and the like*. William E. Ficklen. Patented June 2, 1914.

1,098,710. *Asphalt roadway*. Edward M. Chadbourne. Patented June 2, 1914.

1,098,792. *Street pavement*. William E. Ficklen. Patented June 2, 1914.

1,099,008. *Road grader and scraper.* Jacob F. Bennett. Patented June 2, 1914.

1,099,371. *Road scraper.* Cornelius Howard. Patented June 9, 1914.

1,099,487. *Paving for earth fill dams.* William L. Church, assignor to Ambursen Co. Patented June 9, 1914.

1,100,821. *Road drag.* James J. Fitzgerald. Patented June 23, 1914.

1,101,766. *Grading machine.* Thos. F. Stroud. Patented June 30, 1914.

1,101,909. *Guard for cement work.* Samuel H. Dolbear. Patented June 30, 1914.

1,101,936. *Road spraying machine.* John A. Johnston. Patented June 30, 1914.

1,102,189. *Road Drag,* Charles W. Faris. Patented June 30, 1914.

1,102,235. *Adjustable sectional railroad crossing.* James W. Brees and Oscar L. Hupp. Patented July 7, 1914.

1,102,435. *Finishing machine.* Anthony J. Powers. Patented July 7, 1914.

1,102,443. *Road roller.* Otto A. Schamell. Patented July 7, 1914.

1,102,671. *Road Grader.* D. W. King. Patented July 7, 1914.

1,102,927. *Method of making roadbeds and pavements.* John A. Johnston. Patented July 7, 1914.

1,103,127. *Asphaltic pavement.* Edward M. Chadbourne. Patented July 14, 1914.

1,103,472. *Metal frame and concrete sidewalk, etc.* Harry F. Bayley. Patented July 14, 1914.

1,103,483. *Artificial stone cement.* Giovanni Capece. Patented July 14, 1914.

1,103,936. *Road machine.* Joseph Brophy. Patented July 21, 1914.

1,103,951. *Road scraper.* G. Eyers. Patented July 21, 1914.

1,104,633. *Spraying apparatus.* W. Cressy. Patented July 21, 1914.

1,105,260. *Metal bound curbing.* Anthony E. Davis. Patented July 28, 1914.

1,105,580. *Roadbed and process for making same.* Benjamin F. Richardson. Patented July 28, 1914.

1,105,781. *Guard and curb.* Thomas A. Hill. Patented August 4, 1914.

1,105,826. *Vault cover.* Ralph A. Norton. Patented August 4, 1914.

1,105,873. *Means for fastening floor and sidwalk gratings.* Nathan Berson. Patented August 4, 1914.

1,105,905. *Artificial stone composition.* William Heslop. Patented August 4, 1914.

1,106,292. *Lock.* William Fields. Patented August 4, 1914.

1,106,298. *Colored cement structure and process of making same.* Henry A. Gardner. Patented August 4, 1914.

1,106,951. *Combined road grader and roller.* Joseph F. Langer. Patented August 11, 1914.

1,107,171. *Charging device for concrete mixers.* P. A. Koehring. Patented August 11, 1914.

1,107,186. *Road machine.* M. M. Sickler. Patented August 11, 1914.

1,107,457. *Grading machine.* Linsey F. Smith. Patented August 18, 1914.

1,107,460. *Wheeled Scraper.* John E. Steele. Patented August 18, 1914.

1,107,628. *Attachment for plows.* N. A. Roden. Patented August 18, 1914.

1,107,770. *Road dresser.* Harvey L. Eggleston. Patented August 18, 1914.

1,107,880. *Composition for agglutinating dust.* Hermann Belger. Patented August 18, 1914.

1,108,126. *Road drag.* Thomas Y. Boyd. Patented August 25, 1914.

1,108,852. *Drainage plant for roadbeds.* Karl Scheuermann. Patented August 25, 1914.

1,108,925. *Wheeled grader.* Alexander Morton and Maurice A. Brase. Patented September 1, 1914.

1,109,866. *Adjustable grader.* James R. Nanamaker. Patented September 8, 1914.

1,110,295. *Pavement.* Victor L. Phillips. Patented September 8, 1914.

1,109,120. *Water-repellent cement and process of making same.* Carleton Ellis. Patented September 1, 1914.

1,109,540. *Waterproof concrete composition.* Hans Olson. Patented September 1, 1914.

1,111,420. *Grader.* William F. Wainright. Patented September 22, 1914.

1,111,839. *Protecting plate for the edges of concrete constructions.* Thomas Henry Kane, assignor to Trussed Concrete Steel Co. Patented September 29, 1914.

1,111,900. *Road drag.* Samuel E. Hughes, assignor of one-half to Samuel G. Phillips. Patented September 29, 1914.

1,112,713. *Road scraper.* Angus McCallum. Patented October 6, 1914.

1,112,817. *Toughened pitch composition.* Emil L. Manhayfer. Patented October 6, 1914.

1,113,139. *Machine for applying bituminous materials and the like to roads.* Edward C. Perry and Frank D. Perry, assignors to American Car Sprinkler Co. Patented October 6, 1914.

1,113,555. *Aggregate for concrete.* Frank M. Haldeman, assignor to the Master Builders Co. Patented October 13, 1914.

1,113,643. *Apparatus for the even distribution of liquids.* August Jonas, assignor to Farben-Fabriken Vorm, Friedr, Bayer & Co. Patented October 13, 1914.

1,113,733. *Armoured pavement joint.* Robert D. Baker. Patented October 13, 1914.

1,113,784. *Gutter section.* Gertrude Higman. Patented October 13, 1914.

1,114,140. *Hardening cementitious materials.* Aaron C. Horn. Patented October 20, 1914.

1,114,189. *Method of treating roads.* Wm. H. Shoonmaker, assignor to Sam E. Finley. Patented October 20, 1914.

1,114,442. *Snow scraper.* Charles James Brodie. Patented October 20, 1914.

1,114,919. *Liquid hydrocarbon distributor for roads.* David Schoentag and Elmer J. Latus. Patented October 27, 1914.

1,114,980. *Apparatus for making briquets.* Samuel B. Goff. Patented October 27, 1914.

1,115,259. *Composite pavement.* Edwin C. Wallace. Patented October 27, 1914.

1,115,900. *Scarifier.* D. B. Cook. Patented November 3, 1914.

1,116,305. *Road drag.* O. C. Luther, assignor of one-seventh to each of seven persons. Patented November 3, 1914.

1,116,306. *Flexible road drag.* Otto C. Luther, assignor of one-seventh to each of seven persons. Patented November 3, 1914.

1,116,788. *Self-propelled road builder's vehicle.* Harvey W. Bell. Patented November 10, 1914.

1,116,857. *Street construction.* Chester N. Stevens. Patented November 10, 1914.

1,116,941. *Machine for heating and mixing paving materials.* Thomas L. Smith and Edward W. Brackenbury, assignors to T. L. Smith Co. Patented November 10, 1914.

1,117,324. *Scraper,* C. Child and A. H. Keir. Patented November 17, 1914.

1,117,333. *Road making machinery.* William Cooper. Patented November 17, 1914.

1,117,467. *Road grader.* Bennie Whittemore. Patented November 17, 1914.

1,117,561. *Portable machine for treating asphalt, mastic, and related materials.* Chas. E. Guelich. Patented November 17, 1914.

1,117,670. Apparatus for the manufacture of mortar. W. C. Hay. Patented November 17, 1914.

1,118,756. Roadway construction. T. H. Flere. Patented November 24, 1914.

1,118,853. Roadbed construction. A. Goddell, Jr. Patented November 24, 1914.

1,119,500. Composition for laying road dust. Carleton Ellis. Patented December 1, 1914.

1,120,177. Street sprinkler. O. A. Yonker. Patented December 8, 1914.

1,120,179. Grading machine. S. W. Blevins. Patented December 8, 1914.

1,120,281. Scraper. Charles Child and Alex. H. Keir. Patented December 8, 1914.

1,120,427. Road roller. L. B. Webster. Patented December 8, 1914.

1,120,471. Culvert. W. H. Franklin. Patented December 8, 1914.

1,121,363. Protective compound for metal surfaces. David M. Howe. Patented December 15, 1914.

1,121,421. Railway track construction in paved streets. Thomas H. Tutwiler. Patented December 15, 1914.

1,121,533. Metal reinforcement for concrete roadways. Frederick P. Obenaur. Patented December 15, 1914.

1,122,384. Machine for heating the surface of roads for covering the same with poured asphalt. A. Grasso. Patented December 29, 1914.

1,122,504. Bridge construction. Geo. Huebner. Patented December 29, 1914.

1,122,866. Expansion and contraction joint. August W. Cordes. Patented December 29, 1914.

REISSUES

13,708. Roadleveling device. N. S. Monroe. Patented March 31, 1914.

13,785. Process of making pavements. J. Y. McClintock. Patented August 4, 1914.

PATENTED METHOD OF ROAD CONSTRUCTION

All manufacturers of road materials were requested to submit description of any patented methods of road construction which they thought should properly be included in this chapter. The information contained herein is based upon the replies received.

Bitulithic Pavement.—This pavement is laid under several patents, the basic principle United States patent being no. 727,505, issued to the late Frederick John Warren. The scope of the patent as given in the opinion in Warren Brothers Company vs. Owosso, Michigan, written by Mr. Justice Lurton, then Presiding Justice of the United States Circuit Court of Appeals, Sixth Circuit, is as follows:

> Warren's invention, shortly stated, consists in the discovery that an aggregate of large and small pieces of stone, together with a certain proportion of stone dust, all mixed together and thoroughly permeated with bitumen or asphalt, results, when set, in a compact, stable structure, is less liable to disintegrate from traffic or weather than any other method of grading or arranging the mineral constituents. Under the evidence, the particles are more compact in their relation to each other and there is a minimum of friction in their interaction. The larger pieces of stone withstand the tendency of the small grains or dust to slip by each other and change the form of the pavement by disintegration and lumpy spots. The result is, therefore, a stability due to the arrangement of the mineral structure which enables the use of a softer asphalt or bitumen than would be otherwise feasible, inasmuch as a greater proportion of the wear and strain is carried by the mineral elements than by the binding constituent.

The Bitulithic surface may be laid on any suitable substantial foundation, such as macadam, new or old; crushed stone properly compressed; concrete, either new or resurfacing foundations of old pavements; old brick; granite block or cobble stones. Bitulithic surface is described by the owners of the patents as follows:

> *Surface:* Upon the foundation is spread the wearing surface which is compressed with a heavy road roller to a thickness of 2 inches. The surface mixture is made of the best stone obtainable, varying in size from a maximum of 1 inch or 1½ inches down to an impalpable powder, the various sizes of smaller stone, sand and impalpable powder being provided to fill the spaces between eth larger stones. The proportions used of the various sizes of mineral are pre-determined by physical tests with a view to obtaining the smallest percentage of air spaces or voids in the mineral mixture, and vary with the character and shape of particles of the stone used in each particular case. After the proportions have been determined, the mineral material is passed through a rotary dryer, from which it is

carried up an elevator and through a rotary screen which separates the mineral material into its several different groups of sizes. The proper proportion by weight of each of these sizes is secured by the use of a scale having seven beams, the exact required amount being weighed out, and run into a double shaft rotary mixer. There it is combined with a bituminous cement which is also accurately weighed in the proper portion. The whole is then thoroughly mixed together and dumped, while still hot, into carts, hauled to the street and spread and thoroughly rolled with heavy steam road rollers.

Grit Surface: After the surface is thoroughly rolled, a flush coat of quick drying bituminous cement is applied to the surface, thoroughly sealing it and increasing its waterproofness. There is then applied a thin layer of finely crushed stone, varying from ¼-inch to ¾ of an inch in size, according to the roughness of the surface desired. The pavement is again thoroughly rolled, leaving the street in a finished condition.

Warrenite Road.—Warrenite Road is a modification of Bitulithic pavement adapted to meet the traffic conditions which exist on country highways.

Bitustone Double Bond Roadway.—This is laid under United States patent no. 1,001,695 issued to August E. Schutte of Northboro, Mass., on August 29, 1911. The construction is briefly described by the eighth claim of the patent, as follows:

> A pavement for foot or vehicular traffic, comprising a mineral aggregate the particles of which are in substantial contact and are otherwise surrounded and bonded together by a rigid non-liquefiable cement, the voids between the bonded mineral particles being filled with elastic cement.

The total depth of the construction recommended by the patentee is 5 inches, as follows:

1. *Foundation or Bottom Course;* of ordinary Portland cement concrete, the mineral aggregate of which may be either crushed stone, gravel, slag or other suitable material.

2. *Bonding Course;* of hard stone or gravel, of nearly uniform size, varying from about 1 inch to ½ inch mixed with neat Portland cement in the proportion of one part cement to six parts stone. The bonding course is tamped and well embedded into the mortar of the foundation or bottom course.

3. *Filler;* after the bonding course is thoroughly set, presenting particles of crushed stone strongly united with neat Portland cement, but containing large percentage of voids between the individual particles, hot bituminous cement especially prepared for the purpose, is flushed over and penetrates into the spaces of the bonding course, and while the cement is still hot the whole surface is covered with fine crusher screenings or coarse sand.

Hassam Pavement.—Upon a well compacted subgrade is spread not less than 5 inches of broken stone in sizes varying from 1½ inches to 2½ inches in diameter. The stone must be clean and fresh with no dirt. After this is rolled and brought to desired cross section the compressed stone is thoroughly grouted. The grout consists of two parts of sand to one or more parts of Portland cement. This grouting is done with a Hassam Patent Grout Mixer driven by a gasoline engine. Before the initial set takes place and during the process of grouting the road is thoroughly rolled. Upon the top of the pavement is then spread a thin layer of pea stone which is also rolled. The Hassam Paving Company, Worcester, Mass.

Patented Materials for Road Construction in which the Method of construction is not patented

To provide information concerning materials the *preparation* of which involves a patent but which are not patented as to their method of *application*, a letter was sent to all road material manufacturers asking them to submit specifications or other suitable material for a special chapter to cover these conditions. The following reports comprise all that have been received:

Amiesite.—A paving material, the ingredients of which are incorporated into a paving mass under patents issued to Joseph Hay Amies and Warren Brothers Company. It consists of the best grade of crushed stone or gravel, graded in sizes from 1½ to ¼ inch (as to give the inherent stability required for a permanent road), chemically treated before applying the asphalt and other material required for the finished product. The stone is then coated, without heating, with an asphaltic cement, composed of refined asphalt containing not less than 98 per cent bitumen and other ingredients. The run-of-the-crusher Amiesite is to be used in the first course; the second course is either ½ or ¼-inch stone, treated in the same manner except it requires additional asphalt per ton of Amiesite, known as "Amiesite Filler." The material is shipped to destination ready for immediate use, without further treatment. By way of summary, it may be stated that the ingredients of Amiesite are crushed stone, asphalt, lime and naptha.

Fibred Asphalt Pavement.—This pavement is laid under several patents, its basic principles involved being covered by United States patent 1040321, applied for April 8, 1911, and issued its patentee, George A. Henderson, of St. Albans, W. Va., on October 8, 1912. The invention relates principally to the art of denaturing hard-wood and preserving it in the following manner: a billet of hard-wood is shredded into small particles of un-uniform lengths of 1½ inches down to wood flour, the flour itself being eliminated from the aggregate by screening. The particles are denatured by the process used by the tannin extract manufacturers, in which process all sap, essence and the more evaporable and deterioble elements in the wood are extracted, the remaining particles being thereby rendered abnormally enlarged and porous. In their subsequently dried and heated condition the wood particles, because of their porosity, are susceptible of impregnation, by absorption, by a non-deteriable, non-evaporating matter (such as asphalt), in lieu of the sap, etc., removed. The heating of the dried particles, to prevent the premature congealing of the molten asphalt before reaching the particles' pores, has also for its object the partial contracting of the enlarged particles. The consequent contraction in the size of the particles' pores correspondingly reduces the amount of asphalt required to completely fill them.

The wood fiber is a waste product of tannin extract manufacturers, who use hard-wood and no bark in their process. The particles are taken from the leaches on endless belts; dried, screened, heated and then mechanically mixed with a predetermined uniform percentage of asphalt, sufficient to fill the pores and voids in the mass when finally contracted and compressed. The material, in its partially impregnated and partially contracted condition is deposited at the mouth of its mixer into moulds 4 by 6 feet, these blocks being compressed on all sides only 3 to 4 inches, and allowed to cool, when they will remain intact for shipment, but are readily disintegrated in a breaker stationed at the front of a portable reheating machine, designed to travel over the road to be paved, in which machine the coated particles are deposited and heated to from 250 to 275° F. This heating results in the final contraction of the fiber to its normal size, as it was before being chipped from its original log, and the entrapping of its asphalt content, thereby insuring penetration to the most minute pore of the fiber, thus thoroughly preserving it, without affecting its natural resiliency. The mass emerges from the rear of the reheating machine in a continuous 18-inch flow on to the previously prepared road base, where it is mechanically spread 4 inches thick, steam roller compression immediately reducing it to a compact mass 2 inches thick. The interlocking of the un-uniform preserved sinews of the hard-wood, in conjunction with the substantial penetration of the binding asphalt, in addition to surrounding the particles, is relied upon for durability.

Fibred Asphalt may be laid on any substantial foundation such as old macadam, crushed stone, concrete, old brick, granite or wood blocks or cobble stones. For use on country roads a curb or shoulder is not necessary.

The only patent in connection with Westrumite Asphalt Pavement, exist in the patents for the emulsifying of the native bitumen (not oil residuum) of which it is made, there are also several independent companies within the United States and Canada manufacturing and marketing this product.

Westrumite.—The patents in connection with Westrumite Asphalt pavement protect the emulsifying of the asphaltum. There are also several independent companies in the United States, Canada and Europe manufacturing and marketing Westrumite.

Westrumite is an asphaltic cement, temporarily liquified by emulsification. It is shipped in tight barrels and without any further preparation is mixed *cold* with the proper stone matter in an ordinary concrete mixer, is laid on any suitable foundation and thoroughly compacted, with a five to eight ton roller. The evaporation of the vehicle leaves the asphaltic cement as the binder.

There are two principle types of construction. The 1st is the mixing process or asphaltic concrete construction, using hard suitable crushed stone of two sizes, namely: ¾ inches to ½ inch and ¼ inch to and including dust. The latter especially is carefully tested and made to conform to specifications designed to give the greatest density. The mixture of the stone and the quantity of Westrumite, are ascertained by a determination of the voids in the stone matter. After the surface is thoroughly compacted a flushing coat is used to fill any small voids or roughness on the surface and the whole is again thoroughly rolled. The surface thickness is 1½ inches for light traffic and 2 inches for heavy traffic.

The other principle type of construction is the combination of the mixing and penetration methods. Crushed stone ranging in size from 2 inches to 1 inch, after being thoroughly coated with Westrumite Asphalt, is spread on any suitable foundation to make a wearing surface of at least 2 inches thickness after rolling. This stone course is not compacted. A second course composed of Westrumite Asphalt and crushed stone from ½ inch to and including dust, in proper proportion is then spread over the coarse stone in sufficient amount to thoroughly fill all the voids. The liquid consistency of this mortar causes it to penetrate and fill the voids of the coarse stone. This process is assisted by the pressure of the roller. The seal coat is also applied in this construction.

Recently another type of construction has come into use which is a bituminous carpet of ½ inch thickness on concrete roads. This carpet is composed of Westrumite Asphalt, mixed *cold* in an ordinary concrete mixer, with stone matter ranging from ¼ inch to and including dust, properly graded. This mixture is spread on the concrete surface to a uniform depth of ½ inch by means of a templet. Owing to the fact that Westrumite asphaltic cement is an aqueous emulsion the adhesion to even damp concrete surfaces is perfect.

National Pavement. This product is manufactured under a United States patent No. 1008433 issued to Michael A. Popkess of Kansas City, Missouri, which covers the material, as well as the process of producing the same. It is impossible to produce National Pavement with the machinery used in manufacturing any other type of bituminous material.

A machine was designed by and patent No. 1062552 issued to Michael A. Popkess. Later improvements were made on the machine for which patents are pending.

National Pavement is composed substantially of absorbent earthy material mixed with a liquified bituminous binder, the earthy material being previously disintegrated to such a degree of fineness as to render it capable of absorbing and combining with the binder to form a coherent homogeneous dense, yet malleable substance.

The process, as carried out in its manufacture, consists in taking ordinary clay, loam or soil subjecting it to a disintegrating treatment in a drum containing means to pulverize in the presence of heat, which simultaneous action of the heat and attrition reduces the material to a fine, dry, hot dust, which is collected and mixed in even quantities. The mixture 2 to 3 inches in thickness is spread upon a well compacted and properly drained earth base and rolled.

A good soft grade of asphalt is used to waterproof and bind the fine earth dust together, which mixed material naturally compacts together under the roller, producing a dense and malleable pavement for street and highway use, substantially free from voids.

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BULLETINS, CIRCULARS AND DOCUMENTS

Publications of the Office of Public Roads, U. S. Department of Agriculture[1]

ANNUAL REPORTS

Report of the special agent and engineer for road inquiry for 1893. Roy Stone.
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1. State laws relating to the managment of roads, enacted in 1888-1893. Compiled by Roy Stone.
2. Proceedings of the Minnesota Good Roads Convention, held at St. Paul, Minn., January 25 and 26, 1894.
3. Improvement of the road system of Georgia. O. H. Sheffield.
4. Report on road-making materials in Arkansas. J. C. Branner.

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[1] The department supply of a number of these publications is exhausted, but copies may be had by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 5 cents each except in the case of bulletins, which range from 5 to 30 cents. A revised list of publications of the Office of Public Roads is issued every three months, and copies can be had upon request to that office.

5. Information regarding road materials and transportation rates in certain States west of the Mississippi River.
6. Information regarding roads, road materials, and freight rates in certain States north of the Ohio River.
7. Information regarding roads and road-making materials in certain eastern and southern States.
8. Earth roads: hints on their construction and repair. Roy Stone.
9. State aid to road building in New Jersey. Edward Burrough.
10. Proceedings of the National Road Conference, held at Westminster Church, Asbury Park, N. J., July 5 and 6, 1894.
11. Proceedings of the Virginia Good Roads Convention, held in Richmond, Va., October 18, 1894.
12. Wide Tires. Laws of certain States relating to their use, and other pertinent information. Compiled by Roy Stone.
13. Kentucky highways: history of the old and new systems. M. H. Crump.
14. Good roads: extracts from messages of governors. Compiled by Roy Stone.
15. Proceedings of the Good Roads Convention of Texas, held at Turner's Hall, in Houston, Tex., February 19, 1895.
16. Notes on the employment of convicts in connection with road building. Compiled by Roy Stone.
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17. Historical and technical papers on road building in the United States. Compiled under the direction of Roy Stone.
18. State laws relating to the management of roads, enacted in 1894–1895. Compiled by Roy Stone.
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19. Progress of road construction in the United States: Reports by Delegates to National Road Parliament, held at Atlanta, Ga., October 17–19, 1895.
20. Traction tests. S. T. Neely.
21. Proceedings of the International Good Roads Congress, held at Buffalo, N. Y., September 16 to 21, 1901.
22. Proceedings of the Third Annual Good Roads Convention of the Board of Supervisors of the State of New York, held at Albany, N. Y., January 28 and 29, 1902.
23. Road conventions in the southern States, and object-lesson roads constructed under the supervision of the Office of Public Road Inquiries, with the coöperation of the Southern Railway.
24. Proceedings of the North Carolina Good Roads Convention, held at Raleigh, February 12 and 13, 1902. Compiled by J. A. Holmes.
25. Proceedings of the Jefferson Memorial and Interstate Good Roads Convention, held at Charlottesville, Va., April 2, 3, and 4, 1902.
26. Proceedings of the National Good Roads Convention, held at St. Louis, Mo., April 27 to 29, 1903.
27. The construction of sand-clay and burnt-clay roads. W. L. Spoon.
28. The decomposition of the feldspars. A. S. Cushman and Prevost Hubbard.
29. The Construction of Macadam Roads. A. B. Fletcher.
30. The Corrosion of Iron. A. S. Cushman.
31. Examination and classification of rocks for roadbuilding, including the physical properties of rocks with reference to their mineral composition and structure. E. C. E. Lord.
32. Public-road mileage, revenues, and expenditures in the United States in 1904. M. O. Eldridge.

33. Road materials of southern and eastern Maine. Prepared in coöperation between the United States Geological Survey, the State Survey Commission of Maine, and the Office of Public Roads. Henry Leighton and E. S. Bastin.
34. Dust preventives. Prevost Hubbard.
35. The preservation of iron and steel. A. S. Cushman.
36. Descriptive catalogue of the road model exhibit of the Office of Public Roads, Alaska-Yukon-Pacific Exposition. Prepared by the Office of Public Roads.
37. Examination and classification of rocks for road building, including the physical properties of rocks with reference to their mineral composition and structure. Edwin C. E. Lord.
38. Methods for the examination of bituminous road materials. Prevost Hubbard and Charles S. Reeve.
39. Highway bridges and culverts. Charles H. Hoyt and William H. Burr.
40. The road material resources of Minnesota. George W. Cooley.
41. Mileage and cost of public roads in the United States in 1909. J. E. Pennybacker, Jr. and Maurice O. Eldridge.
42. New Hampshire highways. Report of an inspection of highways in the State of New Hampshire, August, 1911. Charles H. Hoyt.
43. Highway bridges and culverts. Charles H. Hoyt and William H. Burr.
44. The physical testing of rock for road building, including the methods used and the results obtained. June, 1912. Albert T. Goldbeck and Frank H. Jackson.
45. Data for use in designing culverts and short span bridges. C. H. Moorefield.
46. Oil-mixed portland cement concrete. August, 1912. L. W. Page.
47. Descriptive catalogue of road models.
48. Repair and maintenance of highways. L. I. Hewes.
23.[1] Vitrified brick as a paving material for country roads.
53.[1] Object-lesson and experimental roads, and bridge construction of the U. S. Office of Public Roads, 1912–13.
105.[1] Progress reports of experiments in dust prevention and road preservation, 1913.
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14. Addresses on road improvement. Roy Stone.
15. An act to provide for the construction of roads by local assessment, county, and State aid, passed by the New York Assembly.
16. Highway Taxation: Comparative results of labor and money systems.
17. Origin and work of the Darlington Road League. Roy Stone.
18. Report of committee on legislation Adopted by the State Good Roads Convention, held in Richmond, Va., October 10 and 11, 1895.
19. Traffic of the country roads.
20. Comments on systems of maintaining country roads.
21. Methods of constructing macadamized roads. Extract from a report prepared by the chief engineering inspector of the Local Government Board. (England.)
22. Appeal for organization of State and local road-improvement societies. C. A. Locke.
23. Money value of good roads to farmers. W. C. Latta.

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[1] U. S. Department of Agriculture Bulletin.
[2] Circulars 1 to 13 were of temporary character and are no longer in print.

24. Highway maintenance and repairs. Revision of Circulars 16, 20, and 24.
25. Brick paving for country roads.
26. Going in debt for good roads.
27. Cost of hauling farm products to market or to shipping points in European countries.
28. Addresses on road improvement in Maine, New York, North Carolina, and Illinois. Roy Stone.
29. The forces which operate to destroy roads, with notes on road stones and problems therewith connected. C. L. Whittle.
30. Repairs on macadam roads. E. G. Harrison.
31. Must the farmer pay for good roads? Otto Dorner.
32. State aid to road building in Minnesota. A. B. Choate.
33. Road improvement in governors' messages. Compiled by Roy Stone.
34. The social, commercial, and economic phases of the road subject. W. H. Moore.
35. Road improvement in New York.
36. List of national, State, and local road associations and kindred organizations in the United States.
37. The railroads and the wagon roads. A. L. Craig.
38. A study of rock decomposition under the action of water. A. S. Cushman.

39 to 46 inclusive. Public roads of Washington, Arizona, Arkansas, Oregon, Iowa, Virginia, North Carolina, and Alabama: Mileage and expenditures in 1904. M. O. Eldridge.

47. Tar and oil for road improvement: Report of progress of experiments at Jackson, Tenn.

48 to 87 inclusive. Public roads of Tennessee, New Hampshire, Maryland, Maine, New Mexico, Pennsylvania, Montana, Wyoming, North Dakota, South Dakota, Kentucky, Florida, South Carolina, Nebraska, Nevada, Kansas, Idaho, Colorado, Indiana, Oklahoma, Utah, California, Illinois, New Jersey, Missouri, Louisiana, New York, Ohio, Georgia, Mississippi, West Virginia, Wisconsin, Minnesota, Delaware, Michigan, Rhode Island, Massachusetts, Texas, Connecticut, and Vermont: Mileage and expenditures in 1904. M. O. Eldridge.

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90. Progress reports of experiments in dust prevention, road preservation and road construction.
91. Sand-clay and earth roads in the Middle West. W. L. Spoon.
92. Progress reports of experiments in dust prevention and road preservation.
93. Bitumens and their essential constituents for road construction and maintenance. Prevost Hubbard.
94. Progress reports of experiments in dust prevention and road preservation, 1910. Prepared by the Office of Public Roads.
95. Special road problems in the southern States. D. H. Winslow.
96. Naphthalene in road tars. I. The effect of naphthalene upon the consistency of refined tars. Prevost Hubbard and Clifton N. Draper.
97. Coke-oven tars of the United States. Prevost Hubbard.
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100. Typical specifications for the fabrication and erection of steel highway bridges.

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95. Good roads for farmers. M. O. Eldridge.
136. Earth roads. M. O. Eldridge.
235. Cement mortar and concrete: preparation and use for farm purposes. P. L. Wormeley.
239. The corrosion of fence wire. A. S. Cushman.
311. Sand-clay and burnt-clay roads. W. L. Spoon.
321. The use of the split-log drag on earth roads. D. W. King.
338. Macadam roads. A. B. Fletcher.
403. The construction of concrete fence posts. Prepared by the Office of Public roads.
461. The use of concrete on the farm. Prepared by the Office of Public Roads.
505. Benefits of improved roads. September, 1912.
597. The road drag and how to use it.

YEARBOOK ARTICLES

(Extracts from the Yearbooks of the Department of Agriculture)

Yearbook of the Department of Agriculture, 1894

24. Best roads for farms and farming districts. Roy Stone.
25. State highways in Massachusetts. G. A. Perkins.
26. Improvement of public roads in North Carolina. J. A. Holmes.

Yearbook of the Department of Agriculture, 1895

40. Coöperative road construction. Roy Stone.

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118. Object-lesson Roads. Roy Stone.

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149. Steel-track wagon roads. Martin Dodge.
150. Construction of good country roads. M. O. Eldridge.

Yearbook of the Department of Agriculture, 1899

172. Progress of road building in the United States. M. O. Eldridge.

Yearbook of the Department of Agriculture, 1900

204. The selection of materials for macadam roads. L. W. Page.
210. Mountain Roads. J. W. Abbott.

Yearbook of the Department of Agriculture, 1901

240. Road building with convict labor in the southern States. J. A. Holmes.
245. Government coöperation in object-lesson road work. Martin Dodge.
253. Mountain roads as a source of revenue. J. W. Abbott.

Yearbook of the Department of Agriculture, 1902

296. Use of mineral oil in road improvement. J. W. Abbott.

Yearbook of the Department of Agriculture, 1903

305. Progress of road building in the Middle West. R. W. Richardson.
332. Building Sand-clay roads in southern States. W. L. Spoon.

Yearbook of the Department of Agriculture, 1904

350. Practical road building in Madison County, Tennessee. S. C. Lancaster.

Yearbook of the Department of Agriculture, 1905

407. Progress of road legislation and road improvement in the different States. Prepared in the Office of Public Roads.

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412. Object-lesson roads. L. W. Page.

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448. Dust preventives. L. W. Page.

Yearbook of the Department of Agriculture, 1909

513. Information in regard to fabricated wire fences and hints to purchasers. Allerton S. Cushman.

Yearbook of the Department of Agriculture, 1910

535. Progress and present status of the good roads movement in the United States. Logan Waller Page.
538. Bituminous dust preventives and road binders. Prevost Hubbard.

LECTURE SYLLABUS

Syllabus of Illustrated lecture on roads and road building. Office of Experiment Stations, Farmers' Institute Lecture 7. Office of Public Roads.

Publications of the Bureau of Chemistry on Road Materials

The following publications were issued by the Bureau of Chemistry when the Office of Public Roads formed a part of that Bureau.

BULLETINS

79. The testing of road materials, including the methods used and the results obtained in the road material laboratory in collaboration with the Office of Public Road Inquiries. L. W. Page and A. S. Cushman.
85. The cementing power of road materials. L. W. Page and A. S. Cushman.
92. The effect of water on rock powders. A. S. Cushman.

CIRCULAR

17. The useful properties of clays. A. S. Cushman.

SPECIAL BULLETIN

A special bulletin on "Highway Bonds" has been prepared by the Office of Public Roads and will be issued as a congressional document.

Publications of the Joint Congressional Committee on Federal Aid in the Construction of Post Roads

Public road systems of foreign countries and of the several States. Hearings before the Joint Committee.

Good roads chart. Showing possible factors of distribution for Federal Aid, public highway systems of foreign countries and of the several States, and cost of constructing tabular roads in various sections of country.

Report on Rural Free Delivery Roads.

Alabama

State Highway Department
- Bulletin 1. State highway laws of Alabama in effect April 5, 1911.
- Bulletin 2. Roads and road materials of Alabama. W. F. Prouty.
- Bulletin 3. First annual report of the State highway commission, 1912.
- Bulletin 4. Second annual report of the State highway commission, 1913.
- Bulletin 5. Addresses by Governor Emmet O'Neal and G. N. Mitcham. Cost keeping in county road work. R. P. Boyd.
- Bulletin 6. Third annual report of the State highway commission of Alabama.

Association of Highway Engineers, Annual Proceedings, Latest 1912–1913.

Alaska

Board of Road Commissioners, War Department
- Annual reports, latest issued October, 1913.

Arizona

Reports of State Engineer.

Arkansas

Highway Bulletin. Issued monthly by State Highway Commission.

California

Report Surveyor General, 1854

Comments on California and Missouri mail stage road, and Atlantic and Pacific Railroad; also recommendation for appropriation for locating and constructing portion of proposed California and Missouri stage road lying between some point in great central valley of State, and its eastern boundary.

State Convention of Supervisors, San José, 1896.
- Road sprinkling. Paper read before State Convention of County Supervisors at San José, by M. Manson. 1896.

Commissioner of Public Works
- Reports, 1894 to 1904.

Department of Highways
- Biennial Reports, 1895–96 to 1904–06.
- Bulletin 1. An act to create a bureau of highways and prescribe its duties and powers and to make an appropriation for its expenses (1895).
- Bulletin 2. An act providing for the erection and operation of rock crushing plants at the State prisons for the preparation of highway material for the benefit of the people of the State, and providing for the necessary advances and appropriation of money to carry out said work (1895).
- Bulletin 3. Physical features of the State.
- Bulletin 4. The effect of roads on industrial development.
- Bulletin 5. Proposed highway legislation with comments and resolutions thereon.

State Engineer
  Reports from 1878–79 to 1908–10–12.
State Mineralogist
  Reports, twelfth, 1892–94; thirteenth, 1894–96.
  (Macadam in Alameda, Los Angeles, Marin, San Francisco, Solano, and Sonoma Counties.)
California's State Highway. Austin B. Fletcher, Highway Engineer, California Highway Commission, August 5, 1912.
California Highway Bulletin, issued bi-monthly by California Highway Commission, Sacramento.

Colorado

State Highway Commission
  Biennial Report, first and second, 1910–1912.
  Bulletin 1. Act establishing highway commission, 1910, Regulations, etc.
  Bulletin 2. Act establishing highway commission, 1911, and road laws of Colorado.
  Bulletin 3. General rules, regulations and highway commission Act. 1913.
  Bulletin 4. General forms, specifications and plans, 1914.

Connecticut

State Highway Commissioner
  Annual Reports, 1895 to 1900, inclusive.
  Biennial Reports, 1901–02 to 1907–08, inclusive.

Delaware

Delaware State Highway Commission
  Biennial Report, first, 1903–04.
New Castle County State Highway Commission.
Biennial Reports, first to fourth, 1905–06 to 1911–12, and January, 1915.
Annual Reports County Road Engineer, Newcastle County,
  (6) 1908–1913 inclusive, Wilmington.

District of Columbia

Engineer Department
  Annual Reports.
  Report of the Operations of the Engineer Department, 1899–1900 to 1911–14.

Florida

State Geological Survey
  Bulletin 2. Roads and road materials in Florida. E. H. Sellards, et al.

Georgia

Geological Survey
  Bulletin 8. A preliminary report on roads and road building materials of Georgia (1901). S. W. McCallie.
  Bulletin 24. A second report on the public roads of Georgia (1910). S. W. McCallie. (First report, Bulletin 8.)
  Bulletin 28. A third report on the public roads of Georgia (1912). S. W. McCallie.

Georgia University. State College of Agriculture.
    Bulletin, vol. 9, no. 5. Good roads for Georgia.
State Prison Commission.
    Annual Reports, thirteenth to sixteenth, 1909–10 to 1912–13.

Idaho

Agricultural Experiment Station
    Bulletin 45, 1904. Road construction.
    Bulletin 50, 1905. Road construction.
State Engineer
    Biennial Reports, third, 1899 to 1900; sixth 1904 to 1906; eighth 1908 to 1910; ninth 1911–1912.

Illinois

Agricultural Experiment Station
    Bulletin 65, 1901. Road construction and maintenance.
Highway Commission
    Annual Reports from 1906 (1906 and 1908–1909 out of print). 1910–11–12.
    Bulletin 1. Earth road drag, how to make it and how to use it (out of print).
    Bulletin 2. Road drag law and rules for dragging.
    Bulletin 3. How to secure bridge plans. Information for county, township, and municipal officers (out of print).
    Bulletin 4. Crushed stone prepared by convict labor and rules for its use (out of print).
    Bulletin 5. General rules and regulations (out of print).
    Bulletin 6. Modern bridges for Illinois highways (out of print).
    Bulletin 7. Township hard road law (out of print).
    Bulletin 8. Manual of Instructions to engineers.
    Bulletin 9. Modern bridges (which is a revision of bridge bulletin No. 6.)

Under the present State Highway Department, the following publications have been issued:
    Bulletin 1. Qualifications for county superintendents of highways (out of print).
    Bulletin 2. Information for county boards.
    Bulletin 3. Policy of the State highway commission.
    Bulletin 4. Part I. Suggestions for the Guidance of County Superintendents of Highways.
    Bulletin 5. Rules and regulations of the Illinois highway commission applying to bridge design.
    Bulletin 6. Synopsis of the Illinois Road Law.
State Geological Survey.
    Bulletin 9. Paving brick and paving brick clays of Illinois (1908).
Illinois University. Engineering Experiment Station.
    Bulletin 65. Construction and care of earth roads. Ira O. Baker.
Illinois Highways, Monthly Bulletin.

Indiana

State Geological Survey.
    30th Annual Report. 1905. Roads and road materials of Indiana. W. S. Blatchley and Assistant.
State Statistician, Annual Report for 1910. Data on mileage of improved roads.

Iowa

State Highway Commission.
- Annual reports 1904–05 (out of print).
- Manual for Highway Officers, 1905–06 (out of print).
- Bulletin, vol. 3, no. 1. Road and Bridge Improvement in Iowa, 1908.
- Service Bulletin no. 1. June edition. (A summary of the Iowa road laws.)
- Service Bulletin no. 2. Standard Specifications for Concrete Reinforcement Bars.
- Monthly Service Bulletin. Published monthly beginning December, 1913.
- Supplement to vol. II, no. 1, Monthly Service Bulletin. Standard Specifications for Highway Bridge Construction.
- Standard concrete superstructures for steel, and concrete bridges.
- Standard deck girder superstructure.
- Standard three girder.
- Standard riveted low truss with concrete floor, with joists.
- Standard riveted low truss with concrete floor, without joists.
- Concrete box culverts.
- Concrete slabs.
- Circular culverts.
- Metal culvert headwalls.
- Piling abutments for steel superstructures.
- Wood pile bridges.

Iowa State College. Engineering Experiment Station.
- Bulletin, vol. 2, no. 6. The good roads problem in Iowa. Iowa State Highway Commission.

Engineering Experiment Station, Iowa State College.
- Bulletin 28. Road Legislation and Administration, October. 1912.
- Service Bulletin 1. New road legislation enacted by the thirty-fifth general assembly.

Kansas

Agricultural Experiment Station
- Bulletin 142, 1907. Road improvement.

State Agricultural College
- Bulletin, vol. 3, no. 6. Highway improvement: construction and maintenance of earth, sand-clay, and oiled earth roads, and culverts. W. S. Gearhart.
- Bulletin 1, vol. 5. Land drainage. H. B. Walker.
- Public highways in Kansas. W. S. Gearhart.
- Reprint from nineteenth biennial report of State Board of Agriculture.

Kentucky

Governor's Message, 1827
- State control of roads and bridges urged.

State Board of internal Improvement
- Annual report, 1837. Directions for construction of turnpike roads.

Governor's Message, 1838–39
- Review of history of internal improvement of the past. A large number of reports and bulletins were issued by the State Board of Internal Improvement and the Legislature regarding toll roads.

State Auditor
- Biennial report, 1881–83. Statement showing number of turnpikes in which State owns stock, length of each in miles, whole number of shares of stock, number owned by State, amount per share, average per cent stock has paid for six years prior to January 1, 1882; amount of dividends paid State, cost for salaries to gate keepers and officers, and cost of repairs. 1882–1885.

State Geological Survey
Report of progress. 1886–87. Historic sketch of turnpike road and railroad building in Kentucky. 1775–1820.
Bureau of Agriculture, Horticulture and Statistics
Annual report, eighth, part 2, 1889. Conditions of public highways in Kentucky, 1889.
Bureau of Agriculture. Labor and Statistics
Biennial report, twelfth, 1895–97, Estimated number of miles of macadamized turnpikes in State; end of twelve months will probably see last of old toll system and inauguration of new system of maintenance by taxation, 1897.
Biennial report, thirteenth, 1898–99.
Biennial report, eighteenth, 1908–09, Division 4. Roads.
State Farmers' Institutes
Annual State Farmers' Institute.
First, 1906. Country roads. Address on roads.
Second, 1907. Dirt roads, their construction and maintenance.
Third, 1908. County roads.
Fourth, 1909. Good roads in Kentucky.
Fifth, 1910. Road legislation in Kentucky. McCracken County Judge.
Report relative to public improvements, 1909.
State department of public roads, 1913
Bulletin 3. Information concerning the Office of Public Roads.
Bulletin 4. Compilation of Kentucky road laws.
Bulletin 5. Split Log Drag.
First Biennial Report of the Department of Public Roads, 1913.
Bulletin 6. Compilation of Kentucky road laws (including Acts 1914 General Assembly).
Bulletin 7. Highway bridge lettings.
Bulletin 8. Questions and answers. (Information concerning department and State aid work.)
Specifications. Bridges, culverts, etc.
Questions and answers. Examination for county road engineer.

Louisiana

Board of State Engineers
Biennial Reports, 1872–73 to 1908–10, inclusive.
Agricultural Experiment Station
Geology and agriculture, part 5, 1899. Road making.
Gamble's compendium of the law of roads in Louisiana, with special forms for bond and tax elections.

Maine

Commissioner of highways
Annual Reports 1905 to 1914 inclusive.
Bulletin 1. Improvement of country roads, 1909.
Bulletin 2. Road administration.
Bulletin 3. Duties of selectmen and road commissioners.

Maryland

State Geological Survey
Report on the highways of Maryland, 1899.
Report on the highways of Maryland with especial reference to the operations of the highway division during 1900 and 1901 (1902).
Report on the highways of Maryland with especial reference to the operations of the highway division during 1902 and 1903 (1903).

Report on the Highways of Maryland for the period from January 1, 1904 to May 1, 1905 (1906).
Report on State highway construction for the period from May 1, 1905 to January 1, 1906 (1906).
Report on State highway construction for the period from January 1, 1906 to January 1, 1908 (1908).
Report on State Highway construction for the period from January 1, 1908 to January 1, 1910 (1910).
First, second, third and fourth annual reports of the State Roads Commission for 1908, 1909, 1910, and 1911.
Progress report for 1912 and 1913.

Massachusetts

State Highway Commission
Annual report 1892. Economics of Massachusetts roads.
Table showing mileage of pavements. Road machinery and cost of same. Article on road materials of Massachusetts regarding construction of highways. Statistics showing area, roads, valuations, appropriations, and population with percentages regarding tax and valuation.
Annual report, 1893. In House documents 1894.
Annual reports, 1894 to 1904. In public documents, vol. 12.
Annual report, 1894. Analysis of costs of crushed stone.
Annual report, 1896. Laboratory experiments on road building stones.
Annual report, 1896-1898. Tables showing quantities of work done on each road since 1894 and total cost of same.
Annual report, 1899. Instructions of highway commission to engineers; approved March 30, 1899. Road materials and their physical properties.
Annual reports, first to twentieth, 1893 to 1911-12, 1913-1914.
Highway Association Journal
Volume 1, nos. 2 to 4.
Volume 2, nos. 1 to 4.
Volume 3, nos. 1, 3 and 4.
Volume 4, nos. 1 and 2.
November 1907-08.
June 1910-11.
Proceedings.
Annual report, 1909. Traffic census.
Annual report, 1912. Traffic census on State highways. etc.
Report, 1912. Knowledge of traffic a prerequisite to selection of pavement.
Annual report, 1913. French and English costs, road building and maintenance.
Annual reports 1906 to 1913. Automobile regulations, etc.
Annual Reports 1907 to 1913. Telephone investigations, rates, etc.
State Board of Agriculture
Annual report 1900. Better roads for Massachusetts.
Prize essays on roads and road making. 1870.
State Board of Education
Annual report 1902. Comments on cost of conveyance of children to and from schools.
State Library
Extracts from public hearings given during 1892 in various counties of State regarding width of wagon tires.
Boston Public Library
Preliminary report of the highway commission.

State Legislature

Senate document 164, 1875. Report of Board of Agriculture on most suitable width of rims of wheels of loaded wagons.

House document 253, 1880. Report on subject of "broad rimmed wheels."

Michigan

State Highway Department

Biennial reports 1905-06 to 1913-14.

Bulletin 1. Care of earth roads, 1910. F. F. Rogers (out of print).

Bulletin 2. Gravel roads, 1911. F. F. Rogers.

Bulletin 3. The county road system, 1911. F. F. Rogers (out of print).

Bulletin 4. Macadam roads, 1912. F. F. Rogers.

Circular discussing the county road system, 1914. F. F. Rogers.

Supplementary annual report, 1913. F. F. Rogers.

Concrete steel bridge specifications, 1915.

Minnesota

State Highway Commission

Reports 1 to 4, 1905-07 to 1909-10, 1911.

Bulletin 1. Construction and maintenance of earth roads. G. W. Cooley.

Bulletin 2. Rules and regulations of State highway department of Minnesota.

Bulletin 3. Rules and regulations of State highway department of Minnesota.

Bulletin 4. Better roads for Minnesota. Address by Hon. Logan Waller Page.

Bulletin 5. Additional rules and regulations for the construction and improvement of State roads.

Bulletin 6. Report of the State highway engineer on highway systems of foreign countries.

Bulletin 7. Additional rules and regulations for the construction of State roads and bridges.

Bulletin 8. Specifications for Roads and Culverts.

Bulletin 9. Specifications for Bridges.

Circular 1. Preliminary information.

Circular 2. Highway commission law, chapter 163, General Laws 1905.

Circular 3. Partial digest of the laws pertaining to the highway commission and expenditures of the State aid funds.

Circular 4. Special report to senate for 1912 road work.

Circular 5. Method of procedure for establishment of State rural highways.

Circular 6. Opinion of attorney general regarding expense accounts of assistant engineers.

Bulletin 10. Additional rules and regulations for construction of State roads.

Bulletin 11. Specification for metal culverts.

Bulletin 12. Road laws of Minnesota.

Bulletin 13. Rules for maintenance.

Bulletin 14. Specifications for corrugated metal culverts.

Mississippi

Mississippi Agricultural Experiment Station
  Bulletin 67, 1901. Good dirt roads for Mississippi.
Department of Agriculture and Commerce
  Bulletin, vol. 2, no. 3. Road construction and maintenance.

Missouri

Quite a list of publications is reported by the State highway engineer, covering all that have been issued in the State, but, as all of the publications are out of print, none are listed.

Montana

Montana Good Roads Convention
  Minutes of proceedings, Billings, Mont., 1910.
State Office of Farmers' Institutes
  Montana Farmers' Bulletin 2. Better roads.
Montana Highway Commission
  Specifications for maps and surveys, 1914.
Montana Highway Commission
  Road Pamphlet 1. Road Drag, 1914.
  Montana Road Pamphlet 2. Drainage.

Nebraska

State University. Agricultural Experiment Station
  Press Bulletins. No. 33. Construction and use of the road drag. L. W. Chase.

Nevada

State Engineer
  Biennial reports, 1903–04 to 1911–12.

New Hampshire

State Engineer
  Biennial reports of the governor and council, and of the State engineer relative to highway improvements, 1905–06 to 1911–12.
Agricultural Experiment Station
  Bulletin 30. Experiments in road making. C. H. Pettee.
  Bulletin 46. Road construction and maintenance in New Hampshire.
  Bulletin 77. Road construction in New Hampshire.
State Legislature. House
  Journal, 1893. Report of committee on roads, bridges, and canals accompanying joint resolution for appropriation for highways.
State Board of Agriculture
  Making and repairing roads. M. Humphrey, 1872.
  Annual report, 1894–96. Proceedings of first good roads convention.
State Bureau of Labor
  Biennial report, fourth, 1901–02. New Hampshire highway statistics with tables showing by town and county, taxes assessed for all purposes, amount expended on highways, amount expended for repairing of highways in summer, amount expended in breaking roads in winter, number of miles of highway, daily wages, etc.
State Engineer
  Biennial Report 1905–06 to 1909–10.
  Biennial Report State Superintendent of Highways 1911–12.

New Jersey

Commissioner of Public Roads
Annual reports, 1894 to 1913.
Agricultural Experiment Station
Report for 1901. Road construction.

New Mexico

Territorial Engineer
Second biennial report to the governor. Construction of good roads p. 165. Cost of road construction, p. 176.
State Engineer
State Roads Commission
Annual report, 1912.

New York

State Department of Highways
Proceedings of the first to third semi-annual conference of the State commission and county superintendents of highways of the State of New York, 1909-10.
State Department of Highways. Bureau of Research
Annual Report, 1909-10. Two volumes.
State Commission of Highways
Reports, 1909, 1910, 1911, 1912.
State Commission of Highways. Bureau of Town Highways
Bulletin 1. Practical suggestions and directions to highway officials relating to construction and improvement, repair and maintenance of town highways and bridges. F. D. Lyon.
State Engineer and Surveyor
Annual report, 1899. History of road improvements during year; arranged by roads.
Annual report, 1899. Engineer's suggestions regarding employment of prison labor to improve public highways of State.
Annual Reports, 1901, 02. Suggestions regarding improvement of various State highways funded by means of issuing State bonds bearing interest and to be redeemed in course of seventeen years from issue.
Annual reports, 1902, 03. Proceedings of third and fourth annual good roads convention of board of supervisors of New York State held at Albany.
Annual reports, 1902, 03. Compilation of laws for improvement of public highways.
Annual reports, 1904, 1905, 1906, 1907, 1908.
Bulletin 1. Improvement of public highways (1899).
Bulletin 2. Improvement of public highways (1899).
Bulletin 3. Improvement of public highways. Instructions for obtaining State aid in the improvement of public highways (1901).
Bulletin 4. Issued by U. S. Department of Agriculture as Public Roads Inquiries Bulletin 22.
Bulletin 5. Proceedings of fourth annual supervisors' highway convention of State of New York (1903).
Bulletin 6. Proceedings of fifth annual supervisors' highway convention of State of New York (1904).
Bulletin 7. Improvement, repair and maintenance of public highways (1904).
Bulletin 8. Comparison of progress during period in which the State aid law has been in operation in New York State (1905).
Bulletin 9. Proceedings of the sixth annual good roads convention of the board of supervisors of the State of New York (1905).

Bulletin 10. Road Red Book (1905).
Bulletin 11. Comparison of progress during the period in which the State aid law has been in operation in New York State (1906).
Bulletin 12. Road Red Book (1906).
Bulletins 13, 14, 15. Comparisons of progress during operation of State aid law (1907, 1908).
Proceedings fourth to tenth semi-annual conference of State Highway Commission and County Superintendents of Highways.
Location and drainage of highways. Extract from Bulletin 1.
Erection of culverts and shortspan bridges (Directions for). Extract from Bulletin 1.
State Library
Legislature, Bulletins 16, 19–29, 31, 33, 35, and 36. 1902 to 1908.
State Prison Commission
Annual report, third, 1897. Employment of convict labor in building and improving highways.
State Superintendent of Public Instruction
Annual report, 1900. Good roads and good schools.
State Agriculture Society
Annual report, 1896. Good roads.
Annual report, 1897. Necessity for State aid to roads. O. D. Dorner.
State Museum
Bulletin, vol. 4, no. 17. Road materials and road building in New York (1897).
State Senate
Document 26 (1896), vol. 5. Report of special committee on good roads.
Document 27 (1903), vol. 6. Memorial regarding constitutional amendment to enable State to maintain commercial supremacy by development of main highways and issue of bonds to aid in their construction.
Document 74 (1850), vol. 2. Report of secretary of State regarding number and length of plank roads of State.

North Carolina

State Geological and Economic Survey
Bulletin 4. Road materials and road construction of North Carolina, 1893. J. A. Holmes and W. Cain.
Economic Papers. 2——Some recent Road Legislation in North Carolina.
5. Highway commission
Bulletin 1. Recent road legislation in North Carolina.
27. Highway work in North Carolina, 1911.
28. Culverts and small bridges for country roads, 1912.
30. Proceedings of North Carolina Good Roads Association.
32. Public Roads are Public Necessities.
Good Roads Circulars. 1 to 97, 1902–1914.
Biennial Reports, 1909, 1910, 1912.

North Dakota

State Agricultural Experiment Station
Reports for 1896. Coal and wood ashes for drive-ways and walks.
State Engineer
Biennial reports, first to sixth, 1913–14.

Ohio

State Highway Department
Annual reports from 1905 to 1915.
Bulletin 1. Preliminary instructions and forms. Sam Houston.
Bulletin 2. Construction of country roads. Sam Houston.
Bulletin 3. Maintenance of country roads. Sam Houston.
Bulletin 4. State supervision and State aid. Sam Houston.
Bulletin 5. Convict labor for road improvement. Sam Houston.
Bulletin 6. Condition and cost of country roads in Ohio.
Bulletin 7. Revised instructions and forms. Sam Houston.
Bulletin 8. Road laws of Ohio (exhausted).
Bulletin 9. Proposed amended State aid law. Sam Houston.
Bulletin 10. Road laws of Ohio. Exhausted.
Bulletin 11. Highway maps of the counties of Ohio (exhausted).
Bulletin 12. Report of experiments to determine the comparative value of various road binding materials.
Bulletin 13. Supplemental report of Nelson Avenue experimental road and report of experiments in binding gravel and crushed gravel with tar and asphalt, and also in constructing a waterbound road of gravel.
Bulletin 14. An act creating a State highway department and providing aid in construction and maintenance of highways (supply exhausted but a revised copy in hands of printer).
Bulletin 15. Supplemental report No. 2 on Nelson Avenue experimental road and supplemental report No. 1 on experimental road in Darke County.
Bulletin 16. The effect of wagon roads.
Bulletin 17. Earth roads.
Bulletin 18. A review of the work of the State highway department.
Bulletin 19. South High Street experimental road (preliminary issue).
Bulletin 20. Instructions for dragging roads and road dragging laws.
Bulletin 21. Legislation pertaining to the construction, improvement, maintenance and repair of roads and bridges by the State highway department and an act providing for a levy and designating the main market roads.
Bulletin 22. Highway compendium.
Bulletin 23. Names and numbers of inter-county highways.
Bulletin 24. General specifications for materials (exhausted).
Bulletin 25. General specifications for materials (revised).
Bulletin 26. How to get State aid.
Bulletin 27. Dust prevention.

Oklahoma

State Agricultural Experiment Station
Bulletin 21. Road making and repairing. 1896.
State Geological Survey
Bulletin 2. Preliminary report on rock asphalt, asphaltic petroleum, and natural gas in Oklahoma. 1911.
Bulletin 7. Preliminary report on the clays and clay industries of Oklahoma. 1911.
Bulletin 8. Preliminary report on the road materials and road conditions of Oklahoma. L. C. Snider. 1911.
State Department of Highways
Bulletin 1. Concrete culverts and bridges.
Bulletin 2. Metal culverts.
Biennial report, 1911, 1912.

Oregon

State Highway Engineer
First Annual Report. 1914.
State Agricultural College. Department of Geology and Mining Engineering.
Bulletin 1. Road materials in the Williamette Valley. H. M. Parks. 1911.
Bulletin 2. Highway improvement—earth roads and culverts. E. F. Ayers.
State University
Bulletin, vol. 10, no. 5, Concrete Roads vs. Macadam, E. H. McAllister.

Pennsylvania

State Highway Department
Annual reports from 1904.
Instructions to employes in the construction and maintenance of highways.
Pennsylvania Highway News
Bulletin 1. Supervisors and their duties.
Bulletin 2. Standards.
Bulletin 3. Road drainage.
Bulletin 4. Bridge construction and maintenance.
Bulletin 5. Earth road location and construction.
Bulletin 6. Earth road maintenance.
Bulletin 7. Supervisors' duties.
Bulletin 8. Work and purpose of bureau of township highways.
State Department of Agriculture
Bulletin 15. Good roads for Pennsylvania, 1896.
Bulletin 66. Pennsylvania road statistics by townships. John Hamilton.
Bulletin 69. The road making materials of Pennsylvania. M. C. Ihlsing.
Bulletin 121. Address of Hon. J. W. Hunter, State highway commissioner.

Rhode Island

State Commissioner of Highways
Annual reports, 1895–96, to 1896–97.
State Board of Public Roads
Annual reports from 1902.
State Board of Agriculture
Annual Report, 1899. Advantages of State aid to farmers. W. W. Armstrong.
State General Assembly
Report of the joint committee to examine into the condition of roads and public highways of the State, 1895.

South Carolina

State Superintendent of Public Works
Report, 1832.
State Agricultural Experiment Station. Clemson Agricultural College
Bulletin 48. Broad and narrow tires.
Handbook of South Carolina issued by Department of Agriculture, Commerce and Immigration, 1908.
Commissioner of Agriculture, Commerce and Industries Reports for the years of 1909, 1910, 1911, 1912, 1913 and 1914.
The economic value of good roads, 1910.

Bulletin. Good roads—How to build and maintain them. M. Goode Homes, C.E., University of South Carolina, January, 1912.
Route books, 5 vols. 1912.
Washington to Atlanta highway route book.

South Dakota

State Engineer
Reports, first to fourth; 1906 to 1911–12.
Bulletin 3. Good roads, 1912.
Report of State highway commission to the governor for 1914.

Tennessee

State Highway Commission
Special message of Governor Malcolm R. Patterson to the 57th General Assembly, January, 1911.
State Agricultural Experiment Station
Bulletin, vol. 3, no. 3, 1890. Road construction.

Texas

State University—Mineral Survey
Bulletins, 1901 to 1904. Nine volumes. 1. Texas petroleum, 1901. 3. Coal, lignite and asphalt rocks, 1902.

Utah

State Road Commission
First biennial report, 1909–10.
Second biennial report, 1911–12.
Road laws of the State, 1909.
Road and highway laws, 1912.
Third biennial report, 1913–14.
State University—State School of Mines
Bulletin 2. Tests of macadam rock.
Bulletin 3. Construction and maintenance of earth roads.
Bulletin 4. Economical design of reinforced concrete.
State Engineer
Fourth biennial report, 1903–04.
Fifth biennial report, 1905–06.
Sixth biennial report, 1907–08.
Seventh biennial report, 1909–10.
Eighth biennial report, 1911–12.
Ninth biennal report, 1913–14.

Vermont

State Highway Commissioner
Reports, first to eighth; 1899–1900 to 1913–14.
State Board of Agriculture .
Biennial Report, second, 1873–74. Highways. A. B. Halbert.
State Legislature—Senate
Journal 1855. Report of committee on roads.

Virginia

State Agricultural Experiment Station
Bulletin 34, 1893. Road improvement.

State Highway Commissioner
Annual Reports, first to seventh; 1906–07 to 1910–11, 1912, 1913, 1914.
State Board of Public Works
Reports, 1816, 1818, 1819–20, 1823 to 1847, 1849 to 1855, 1866 to 1876.

Washington

State Highway Department
Bulletin 1. State and county road laws by legislature of 1907.
Bulletin 2. Report to Governor of Washington on convict labor on State roads.
Bulletin 3. State aid roads.
State investigating committee, highway department. Report of the board of control on State rock crushing plants; working convicts on State roads and at crushing plants.
Biennial reports, 1906, 1908, 1910, 1912.
State Agricultural Experiment Station
Bulletin 39, 1899. Road improvement.
State Geological Survey
Bulletin 2. The road materials of Washington.

West Virginia

State Highway Inspector
Partial report, 1908.
State Department of Public Roads
Biennial Report, first, 1909–10.
Circular, September, 1909. Construction and use of split-log drag.
Circular, August, 1910.
Circular, September, 1910.
Circular, October, 1910.
Bulletin 1. Road drags, their construction and use. H. E. Williams.
Bulletin 2. To the county road engineers.
Bulletin 3. Opinion of the attorney general in regard to the road and bridge funds of West Virginia.
State road map, 1911.
Bulletin 1. Road law, July, 1913.
Bulletin 2. Road officials, February, 1914. County and State.
Bulletin 3. Road drags, construction and use.
Bulletin 4. Prison labor.
Bulletin 5. Earth and sand clay roads.
Bulletin 6. Program road school, 1914.
Bulletin 7. Study of West Virginia sands.
Bulletin 8. General specifications for steel highway bridges.
Bulletin 9. General specifications for concrete highway bridges.
Bulletin 10. General specifications for substructures highway bridges.
Bulletin 11. Testing of road materials and laboratory report.
Bulletin 12. Specifications and contract for highway constructions.
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Bulletin 15. Specifications and contract for brick highway constructions.
Bulletin 16. Culverts and drains.
Bulletin 17. Rules for surveyors and camps, prison work, etc.
Bulletin 18. Proceedings road school, 1914.

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Bulletins, price 10 cents

Bulletin 1. The relation of the contractor to the public official. C. A. Crane, secretary, The General Contractors' Association.
Bulletin 2. Modern methods of road surface preservation by bituminous preparations. Chas. W. Ross, superintendent of streets, Newton, Mass.
Bulletin 3. Bond issues for road improvement. Hon. Lee McClung, treasurer of the United States.
Bulletin 4. Good roads and the cost of living. W. W. Finley, president, Southern Railway Company.
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Bulletin 8. The labor problem in road construction. By P. St. J. Wilson, State highway commissioner of Virginia.
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Bulletin 10. Systematizing the purchase of road materials and equipment. By Henry G. Shirley, chief engineer, State roads commission of Maryland.
Bulletin 11. Highway accounting, with special reference to maintenance. By Halbert P. Gillette, M. Am. Soc. C. E., chief editor of "Engineering and Contracting."
Bulletin 12. Unsurfaced roads. By W. S. Keller, State highway engineer of Alabama.
Bulletin 13. The protection and upkeep of road equipment. By Daniel J. Hauer, construction economist and consulting engineer.
Bulletin 14. Waterway structures. By A. R. Hirst, State highway engineer of Wisconsin.
Bulletin 15. Legal suggestions respecting road contracts. By William Law Bowman, C. E., LL. B., New York Bar.
Bulletin 16. Treatment of worn out and ravelled macadam surfaces. Address of Col. E. A. Stevens, State highway commissioner of New Jersey.
Bulletin 17. The selection of materials for macadam roads. By Logan Waller Page, director U. S. Office of Public Roads.
Bulletin 18. Concrete roads. By Hon. Frank F. Rogers, State highway commissioner of Michigan.
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By Charles J. Bennett, State highway commissioner of Connecticut.
Bulletin 33. Bituminous macadam by the cold mixing method.
By Irving W. Patterson, chief engineer, Rhode Island State board of public roads.
Bulletin 34. Convict labor.
By George P. Coleman, State highway commissioner of Virginia.

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Road Periodicals

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Annales des Ponts et Chaussees. 45 francs a year. Bi-monthly. Published by Ecole Nationale des Ponts et Chaussees, 28 Rue des Saints-Peres, Paris, France.

Better Roads. $1.00 per year. Monthly Published by U. B. Publishing House, Jesse Taylor, Editor, Dayton, Ohio.

The Bulletin. $1.00 per year. Monthly. Published by the General Contractors Association, 51 Chambers Street, New York City.

Canadian Engineer. $3.00 per year. Weekly. Published by Monetary Times Printing Company, Ltd., James J. Salmond, Managing Editor, Toronto, Canada.

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Cement Era. 50 cents per year, three years $1.00. Monthly. Published by Cement Era Publishing Company, 1207 Morton Building, Chicago, Illinois.

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Municipal Journal. $3.00 per year. Weekly. Published by Municipal Journal and Engineer, Inc., 50 Union Square, New York City.

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Simplified systems of local road accounting. By Fred W. Buck, deputy highway commissioner of New York.
Efficiency in organization and purchases. By Col. E. A. Stevens, State highway commissioner of New Jersey.
Educational field for highway departments. By Dr. Joseph Hyde Pratt, State geologist of North Carolina.
Engineering supervision of road construction. By W. S. Keller, State highway engineer of Alabama.
Road economics. By J. E. Pennybacker, chief of road economics, United States Office of Public Roads.
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Relationship of the colleges and universities to the good roads movement. By Edward K. Graham. P. 9.
The attitude of the grange towards the present good roads movement. By H. J. Walters. P. 11.

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[1] Magazine articles having descriptive matter were prepared by the publishers. In all other cases title of article only has been given.

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Permanent highways versus temporary construction. By F. Kirby Haskoll. P. 23.
Status and duties of the road engineers. By Joseph Hyde Pratt. P. 28.

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Substitutes for broken stone in road building in the south. By Thos. F. Hickerson. P. 31.

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The Lincoln highway. By Frank D. Lyon. P. 20.

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County highway bridges. By J. N. Ambler. Pp. 10–14.
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HIGHWAY ENGINEERING EDUCATION

Agricultural and Mechanical College of Texas, College Station, Texas

The course consists of three lecture periods per week, of one hour each, during one semester of the junior year. This course covers general elementary study of the subject of country roads and city pavements; character of materials and types of construction; location and drainage of roads; maintenance; road laws; finances; organization and supervision. *Textbook on Highway Engineering*, Blanchard and Drowne.

In addition to the regular course the College also offers a four-weeks winter course for road supervisors and county surveyors covering practical features of the work.—ROBERT J. POTTS, Professor of Highway Engineering.

Alabama Polytechnic Institute, Auburn, Alabama

Roads and Pavements.—Five hours a week for fifteen weeks is devoted to class room instruction in economic principles involved in road improvement—analysis of resistance to traction—location, grades, and drainage of new roads; relocation and improvement of existing roads; construction and maintenance of earth, gravel and macadam roads; bituminous materials in road construction; street plans; width and grade of streets; curbs and gutters; construction of and comparative merit of various kinds of street pavements; construction of sidewalks; street drainage.

Road Materials Laboratory.—Three hours per week for ten weeks. Tests are made of the various road materials to determine physical properties and relative merits of the various materials used in highway construction.

Road and Street Improvement.—Three hours per week for eleven weeks in making surveys, plans and estimates for road and street improvements.

Special One Year Course for Road Foremen and Inspectors.—Elementary work in mathematics, drawing, surveying, and shop work.—JOHN J. WILMORE, Dean of Engineering.

Armour Institute of Technology, Chicago, Illinois

The course is given in the first semester of the senior year, covering a period of eighteen weeks, three hours per week. The study includes economic theory of the location and construction of country roads; design, construction, and maintenance of city streets and pavements, and a study of the various materials used for road building, streets, and pavements.

Blanchard and Drowne's *Highway Engineering* is used as a text, supplemented by lectures, library references and inspection trips to paving work on Chicago Streets.—H. M. RAYMOND, Dean.

Brown University, Providence, Rhode Island

The course covers economics and theory of location and construction of country highways. Emphasis is placed on the relative advantages of the different forms of modern surfaces for country highways; and the adaptability of the different forms of surfaces for city work. Methods of testing various road materials are taught by lecture.

Field trips are required for the purpose of inspecting the many forms of pavements existing about Providence. The work is taught in three hours per week during the second semester of the junior year.—JOHN E. HILL. Professor of Civil Engineering.

Bucknell University, Lewisburg, Pennsylvania

The economic location, design and construction of roads and pavements are considered, comparisons being made between the various methods and materials. Sections of roads and streets are surveyed and from the notes taken plans, specifications and estimates for construction and paving are prepared. The instruction is given in the first term, junior civil engineering, five hours.—C. A. LINDEMANN.

Christian Brothers College, St. Louis, Missouri

Roads and Pavements.—A practical course in road building and street paving. Inspection of work in process of construction.—B. W. LAWRENCE, President.

Cornell University, Ithaca, New York

First Term, Fifteen periods, Fourth Year.—Lecture and recitation course covering methods of construction and maintenance of standard types of roads and pavements.

Second Term, Forty-five Periods, Fourth Year.—Elective course. Lectures recitations and problems covering prevailing methods of location, construction and maintenance of roads and the economics, construction and maintenance of city pavements.—E. E. HASKELL, Dean.

Columbia University, New York City

The graduate course in highway engineering, leading to the master's degree, comprises sixteen courses, equivalent to one academic year of twenty recitation periods per week. The course is given from December to March inclusive, hence, as a residence of one collegiate year is required before the master's degree will be awarded, it is necessary for graduate students in highway engineering to be in residence during two winter periods or the equivalent thereof. All the courses, with the exception of two seminar courses are given in periods of from two to four weeks.

The several graduate courses are: Highway engineering 101—Economics and design of roads and pavements; 102—Broken Stone, gravel and other roads; brick, stone block, wood block, and cement concrete pavements; 103—Bituminous surfaces and bituminous pavements; 104—Highway jurisprudence, highway laws and systems of administration; 105—Highway bridges and culverts; 106—Management engineering; 107—Mechanical appliances used in highway engineering; 108—Non-bituminous road materials, laboratory course; 109—Road surveying and design; 110—Street surveying and design; 111 and 112—Seminars in highway engineering literature: Chemistry H-199—Mining, manufacture, testing and inspection of bituminous materials; H-200—Testing of bituminous materials, laboratory course: Geology H-215—Engineering geology; H-216—Lithology and petrology.

Instruction is given by lectures, seminars, laboratory and library research work, and inspection trips. Besides a special corps of permanent officers of instruction, from twenty to twenty-five non-resident lecturers in highway engineering give lectures in special fields in which they are recognized specialists.

Equipment includes laboratories for the testing of bituminous and non-bituminous highway materials.—ARTHUR H. BLANCHARD, Professor of Highway Engineering.

George Washington University, Washington, D. C.

The course in highways and pavements consists of two lectures a week for the second term of the sophomore year. The course takes up briefly the location and construction of roads, the materials used in road building and the various methods of surfacing. The latter part of the term is given to the study of the different methods of street paving. Other courses give work in surveying, locations, bridges, culverts, etc.—N. W. DOUGHERTY, Professor in Charge.

Harvard University, Cambridge, Massachusetts

In coöperation with the Massachusetts Institute of Technology a comprehensive set of courses in highway engineering was begun in September, 1914. These courses are given as options in the third and fourth year of the undergraduate course in civil engineering. Graduate courses are also offered. The third year subjects only are given in 1914–15, in 1915–16 all the courses will be offered. These courses comprise: road and street construction and drainage; highway location, drawing and design; highway economics; highway specifications; testing highway materials; and the chemistry of road making materials. (See also Mass. Inst. of Tech.)—HECTOR J. HUGHES, Chairman School of Engineering.

Howard University, Washington, D. C.

Roads and Pavements.—One hour per week, first half year. Study of good roads problems, traffic over country roads and city streets and best methods of construction and maintenance for earth, gravel and broken stone roads. Text: Baker's *Roads and Pavements.*—P. B. PERKINS, Director.

Iowa State College, Ames, Iowa

Beginning with the collegiate year 1913–1914 students in Civil Engineering were offered special instruction in Highway Engineering, and those who elect to do so may begin in the second semester of their junior year to take a series of correlated courses covering Highway economics; Systems of administration for state and county road work; Methods of promoting and financing highway construction: Types of roads and pavements; Methods of construction and cost of roads and pavements; Expert reports; Taking and interpreting the traffic census; Design of roads and pavements; Tests of road building materials, including bituminous materials.

The Iowa highway commission has its office at the college, and by coöperation between the civil engineering department and the commission students are often enabled to get summer work on highway construction, or as inspectors of highway bridge construction.—T. R. AGG, Assistant Professor in Civil Engineering, R. A.

Lafayette College, Easton, Pennsylvania

Roads and Pavements.—Location, construction and maintenance of town and country roads, city streets and pavements; street cleaning. Second term, junior year, two periods of one hour each per week. This term extends over eleven weeks.

Road Material Laboratory.—Standard tests of paving brick, and a test on road metal by the Deval machine. We hope to install in the near future a new laboratory for the testing of petroleums, malthas, tars and asphalts. The equipment will be that recommended in Bulletin No. 38 of the Office of Public Roads.—WILLIAM T. LYLE, Professor of Municipal Engineering.

Lehigh University, South Bethlehem, Pennsylvania

Instruction in highway engineering is given to the students in the junior class of the civil engineering department. It consists of two recitations each week for one-half of a college year, in all about thirty-two recitations, supplemented by lectures on highway engineering given by engineers in practice. Each student taking this course has also courses in masonry construction, bridge work, drainage, railway location and instruction in laying out curves and computing earthwork.—FRANK P. MCKIBBEN, Professor of Civil Engineering.

Loyola University, Chicago, Illinois

The course of instruction consists of lectures, recitations, collateral reading, and visits of inspection of road works under construction in this locality. The course includes location, construction and maintenance of roads, and the construction and maintenance of city streets and pavements. WILLIAM H. CAHILL, M.A., M.Sc., C.E., Dean of Engineering.

Maryland Agricultural College, College Park, Maryland

Five periods a week for one term are given to the theory of highway engineering, Such part of eight periods as is necessary is given to practice in the field. This involves reconnaissance, preliminary, location and relocation surveys and includes setting of grade stakes, computation of quantities. etc.

Attention is given in certain other courses to matters pertaining to highway engineering. The subject of highway bridges and culverts is treated in structural design and lectures and laboratory practice on cement and concrete are given during one term.—T. H. TALIAFERRO.

Massachusetts Institute of Technology

HIGHWAY OPTION IN CIVIL ENGINEERING

DESCRIPTION OF SUBJECTS

Highway Engineering.—This course consists of fifteen lectures given during the second term of the third year. It comprises an outline of the principles governing the location, construction, and maintenance of roads, and the construction and maintenance of the various kinds of pavements for city streets. The text-book used is Baker's work on *Roads and Pavements*.

Chemistry of Road Making Materials.—A course of thirty lectures and conferences, with ninety hours laboratory work, in the first term of the third year. It considers the source, preparation, application and tests of cements, bitumens, tars, binders, oils and preservative agents used in connection with road making.

Highway Drawing.—This course supplements the class work of the course in railroad engineering. It requires forty-five hours in the first term and seventy-five hours in the second term of the third year. From notes taken in the field, a map and profile of the preliminary survey for a railroad are plotted and finished. Another problem is the adjustment of a highway location upon a contour map, involving computation of the earthwork. The course also includes drafting showing the applications of the course in railroad engineering to highway work.

Highway Specifications.—A course of thirty hours of lectures and recitations during the second term of the third year, treating of the principles and applications of contracts and specifications applicable to highway construction and practice in writing specifications.

Testing Highway Materials.—A course of thirty hours of lectures and laboratory work during the second term of the third year, in which physical tests of various kinds of materials used in highway construction are made.

Highway Construction.—A course of forty-five recitations given during the first term of the fourth year. This course is an extension of one course in highway engineering and includes a thorough study and discussion of modern highway construction and maintenance, including city pavements and sidewalks; inspections of roads under construction, and critical examinations of pavements in use to determine the effect of traffic and other factors on the wear of street surfaces.

Roadway Drainage.—A course of fifteen exercises given in the first term of the fourth year, in the study of drainage areas, run-off and design of culverts.

Highway Design.—A course of sixty hours in the second term of the fourth year in the design of streets and pavements, including detailed designs, finished plans, and estimates of cost of construction.

Highway Economics.—A course of thirty recitations given in the second term of the fourth year in the methods of financing the construction and maintenance of highways and pavements, and upon the relative economies of pavements, both in first cost and maintenance.

GRADUATE COURSES

COURSES OFFERED TO GRADUATE STUDENTS NOT TAKING THE HIGHWAY OPTION

Road Bitumens and Binders.—A course of fifteen lectures and thirty hours in the laboratory in the second term. This course is intended for civil engineers and deals with the applications and tests of bitumens, tars, oils, paints and chemicals used in the preservation of roads and road structures.

Roadway Construction.—Two hours of lectures or conferences per week accompanied by extensive assigned reading, inspection of road construction, examination of reports and cost records.

(See Harvard University.)

Michigan Agricultural College, East Lansing, Michigan

Road Construction.—Two recitation hours. Six hours field work per week. Spring term of ten weeks. Described as the principles and practice of highway location, construction and maintenance. Required of seniors in the forestry course.

Pavements.—Two lecture hours per week, winter term. Required of seniors in civil engineering.

A study of specifications, methods and materials used in the design, construction and improvement of suburban roads and city streets.

Agricultural Engineering.—Winter term, five lecture hours per week. Treats principally of systems of drainage, construction and improvement of highways and ordinary highways bridges.—G. W. BISSELL, Dean.

New York University, New York City

A course embodying the general principles of highway construction. It includes a study of preliminary and location surveys, foundations, paving materials, consideration of the suitability of various types of roads, dust prevention, street cleaning and maintenance, and side-walk construction. Sophomore, first term. Lectures or recitations, two hours. Textbook *Highway Engineering*, by Blanchard and Drowne.—Chas. H. Snow, Dean.

North Dakota Agricultural College, Fargo, North Dakota

Highway Improvement.—A condensed course in highway construction and maintenance. Special attention is given to the care of earth roads. Three credits for one semester.

Roads and Pavements.—The location, construction, use, economics, care, deterioration, maintenance and repair of earth and metal-surfaced highways; and the economics, construction and maintenance of city pavements with Baker's *Treatise* as a text is offered in the civil and agricultural engineering courses. Four credits for one term.

Country Roads.—A more elementary treatment of the construction and maintenance of country roads is given in the courses in agriculture. Three credits for one term.

Economics of Highway Construction.—Economic and social advantages of improved roads; the traffic census; local and centralized systems of control; highway laws; organization of construction and engineering forces; cost data; methods of handling work; forms of contract, etc. Three credits for one semester.—R. H. Slocum, Professor of Engineering.

Norwich University, Northfield, Vermont

Senior Year, First Semester.—The theory and design of steel highway bridge trusses; reinforced concrete culverts, and bridges; engineering specifications; highway engineering as follows:—The study of the economic principles of road location, construction, maintenance, and cost, the construction and maintenance of road surfaces and pavements.

Senior Year, Second Semester.—Advanced structures; engineering design; highway engineering as follows:—Highway economics, methods of financing, cost of construction and maintenance, inspection of road and pavement work, State highway systems, legal proceeding for improvement, condemnation, assessment of cost, forms of contracts and reports. Highway laboratory as follows:—Complete tests of bituminous and non-bituminous materials.—Arthur E. Winslow, Department of Civil Engineering.

The Ohio State University, Columbus, Ohio

Highway engineering is given in junior year under the general title of "Roads and Pavements." The course runs eighteen weeks and is given three hours of lecture and recitation work per week. The textbook employed is Baker's. In addition to the text assignments students are required to make from thirty to fifty readings of selected articles on highway work from the engineering publications and magazines. The instructor takes the classes out for several short trips to inspect the streets of Columbus and vicinity.—Edward Orton, Dean.

Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma

Instruction consists of three recitations per week for one semester of eighteen weeks. Text-book, Spaulding's *Roads and Pavements*. The laboratory for testing non-bituminous materials has been fitted out. Instruction is given in surveying, computation of earth work, and other civil engineering subjects closely related to highway work.—ALFRED BOYD, Professor of Civil Engineering.

Oregon Agricultural College, Corvallis, Oregon

Instruction in highway engineering at the Oregon Agricultural College is given in a full four-year course leading to the degree of bachelor of science in highway engineering. The course is essentially a civil engineering course but with special emphasis placed on the highway work during the junior and senior years. In addition to the more general civil engineering subjects, such as surveying, masonry and foundations, bridges (theory and design), reinforced concrete (theory and design), the law of contracts, etc., it includes the following technical courses:

Roads and Pavements.—A study of the fundamental principles of location, construction, and maintenance of roads, as well as a thorough study of the materials used in road and street building.

Junior year; first semester; 3 credits.

Cement and Highway Laboratory.—An experimental study of Portland cement; standard A. S. C. E. methods of cement testing; examination of sands, grading of aggregates, determination of voids, etc.; abrasion, hardness, toughness, cementing value, and other tests on macadam rock; tests of paving brick; standard tests on bituminous compounds.

Junior year; first semester; 2 credits.

Highway Engineering.—Economic grades and proper location for different soils and surfacing materials. Surface and sub-surface drainage. Culvert design and construction. Construction and maintenance of earth, sand clay, oiled earth, gravel, macadam, concrete, brick, and other types of roads. Dust preventives and road binders. Preliminary surveys and estimates. Specifications.

Senior year; both semesters; 4 credits each.

Economics of Highway Construction.—Lecture and reading course. Economic and social advantages of improved roads. The traffic census. Local and centralized systems of control. Highway laws of different States. Organization of construction and engineering forces. Cost data. Methods of handling work. Forms of contracts, etc.

Senior year; second semester; 2 credits.

Road Machinery.—A course designed to familiarize the student with the purpose, care, and manipulation of the different forms of power-driven road machinery, both steam and gas, as exemplified in modern road construction.

Senior year; first semester; 1 credit.

Design of Highway Structures.—A draughting room course in the design of different kinds of structures required in highway work.

Elective; senior year; 2 credits.

Advanced Highway Laboratory.—Different road and paving materials and binders are tested and their relative values determined. Sheet asphalt mixtures and bituminous mortars are studied, to determine the effects of various changes in the grading of the aggregates. Finally, samples of various types of roads and pavements are analyzed for density, composition, and grading, with special reference to their conformity with specifications under which built.

Senior year; first semester; 2 credits.—GORDON V. SKELTON, Professor of Highway Engineering.

The Pennsylvania State College, State College, Pennsylvania

Highway engineering is taught in a full four year undergraduate course, essentially a course in civil engineering, but modified by changes in the, latter part so that more time is made available for strictly highway engineering branches. The specialized work in highway engineering, beginning at the middle of the junior year and continuing to the end of the senior year, is as follows: two hours of recitations and lectures per week for one semester in theory of roads and pavements, four hours per week for one semester in laboratory testing of bituminous road materials; and about six hours per week through one year devoted to the necessary surveys, and drawings and computations for the design and estimate of cost for the improvement and reconstruction of a section of a street or road. For experimental and practical study of road building the School of Engineering has available a 12-ton Monarch steam roller, a road grader, a stone crusher, and screens. There are also several log drags, road hones, plows, etc. The laboratory equipment consists of a 4-cylinder Deval abrasion machine, a Dorrey type abrasion machine, a Page impact testing machine for testing toughness of rock, a Page ball mill, briquette machine, and a Page impact machine for testing cementation value of rock, a diamond core drill, a diamond saw, and a 9-inch grinding lap. The laboratory for testing bituminous materials is fully equipped with the usual pycnometers, glass retorts, beakers, flasks, etc., and a Cleveland oil tester, Engler viscosimeter, Dow penetration machine and numerous pieces of minor apparatus necessary to carry on all the usual tests on bituminous materials. In conjunction with the forestry department a creosoting plant is available for treating wood for wood pavements. Experiments are conducted in the uses of dust preventives, the student doing the actual work of sprinkling and treating the road surface.—John P. Jackson, Dean.

Polytechnic Institute of Brooklyn, Brooklyn, New York

The instruction in highway engineering is given during one semester of sixteen weeks, two periods per week. The course consists essentially of oral and blackboard class-room recitations on textbook matter, practically all of Blanchard and Drowne's *Text Book on Highway Engineering* being covered. Problems are assigned for solution out of class-hours. Inspection trips are made for the purpose of examining the various types of pavements and for studying methods of construction. Monthly written quizzes are held and a final examination is given at the end of the term.—C. W. Hudson, Professor of Civil Engineering.

Purdue University, Lafayette, Indiana

Under municipal engineering a six weeks course is offered in highway engineering. It consists of six lectures and eighteen hours of field and drafting work. In addition, the course in testing materials includes the testing of road materials, such as broken stone, gravel cement, concrete and paving brick, by standard methods. An optional course for one year is offered in the senior year, consisting of two lectures and three drafting room hours per week, covering highway engineering.—W. K. Hatt, Professor of Engineering.

Rensselar Polytechnic Institute, Troy, New York

Class-room work includes instruction in economics of roads and pavements; design of grades and of sub-division of a property into streets and lots: surveys for roads and pavements; design and construction of drains.

bridges, culverts, race tracks, equestrian roads, curbs, and sidewalks; design, specifications for and construction of macadam, telford, bituminous macadam, asphalt, brick, stone block and wooden block pavements.

The discussion of bridges and surveys for roads and pavements is given outside of the recitations above mentioned. In the field work the practice covers the methods of laying out streets and lots, grading and giving lines and grades for curbs and pavement surfaces.

In the laboratory the work is as follows: tests of cements and mortars; paving brick tests; macadam tests; abrasion tests in the Deval abrasion cylinders; toughness tests; hardness tests; and tests of bituminous road materials.

Rhode Island State College, Kingston, Rhode Island

The course in highway engineering covers four hours per week for one-half year, three being recitations and lectures and one two-hour period per week for field and laboratory work. The textbook is by Howard Frost. Our field work consists in making a location survey for a piece of road, making a profile, calculating the quantities of cut and fill and cost of construction.

The subject of bridges is studied separately, six hours per week Culverts and arches are studied under the head of masonry.—S. H. Webster, Professor of Engineering.

Rose Polytechnic Institute, Terre Haute, Indiana

The course on roads and pavements is given to the civil engineering students for one hour a week during the second term of the junior year. The work consists of lectures and recitations with a small amount of laboratory work on the inspection and identification of road materials. We have been using Spalding's *Roads and Pavements* for a text-book, supplemented by the pamphlets of numerous manufacturers of paving materials. Special lectures from well known road engineers are arranged for from time to time.—C. Leo Mees, President.

Sheffield Scientific School of Yale University, New Haven, Connecticut

No instruction in highway engineering is given to undergraduates, except that a limited number of senior civil engineers in good standing are allowed to elect the graduate course indicated below.

Graduate Course.—A course in roads and pavements is given to first year graduate students in civil engineering. The total time devoted to the course is 30 hours. Instruction is by means of text book supplemented by assigned articles on highway construction in current engineering publications. About one-half of each exercise of one hour is devoted to recitation on the text, and the remainder to reports on assigned articles by different members of the class. A brief description of certain selected pavements in the city of New Haven is furnished to each student, who is required to make an inspection and render a written report. Groups of three students, working in relays, make traffic observations during one twelve-hour period. Observation blanks are furnished by the city engineer of New Haven, and the results when tabulated are preserved in his office. Several lectures on bituminous materials are given by a member of the Department of Industrial Chemistry. No laboratory work is given. Two written exercises or tests are held at intervals during the term, and a final written examination is required.

A course in highway engineeering is open to first year graduate students in civil engineering. The work consists of studies for the location of a proposed highway including details of drainage, bridges and culverts, traffic and grade. The time devoted to the course is divided between field surveys and office calculations and mapping. Quantities are estimated and probable cost of construction and maintenance under different plans compared. The course in roads and pavements described above is prerequisite.—C. S. FARNHAM.

State College of Washington, Pullman, Washington

There are two courses in highway engineering. One is an introductory course having a value of three hours. This includes a study of the location, construction and maintenance of country roads, city streets and pavements. The effect of alignment, grades, drainage and cross-contour are studied. The course is given one semester of four and one-half months.

The second course, called advanced highway engineering, has a value of five hours. This included a study of the properties of road stone and road binders, and making the test of these materials as recommended by the Office of Public Roads at Washington, D. C. (the department has a complete set of testing machines and laboratory equipment for making these tests) the origin and source of materials, the preparation of the materials for paving, and the effect of traffic and climate on the lasting qualities of the materials. Each class is required to make a model road to the scale of 1½ inch to the foot from some given material. The course is given one semester consisting of two recitations and three three-hour laboratory periods. the text, Blanchard and Drowne *Highway Engineering*, Richardson's *Asphalt Pavements*, etc.

The State University of Iowa, Iowa City, Iowa

The course in highways and highway engineering given is as follows: Location, construction and maintenance of country highways and city streets and walks, cleaning of city streets and methods of assessing costs of construction. The course consists of three recitations for nine weeks. Bridges and culverts are covered in course on structures.—WM. G. RAYMOND, Dean.

State University of Kentucky. Lexington, Kentucky

Two free scholarships are awarded by the fiscal court of each county.

Appointments to this course are good only for rural and highway engineering.

Highway Location: Principles and methods followed in locating highways. Location of several miles of road, five hours per week, second semester. Highway Construction: methods of construction, materials to be used. Determining the size and kind of culverts bridges and other openings on roadways; second semester. Highway Maintenance: Lectures, assigned readings and reports. Inspection of roads in the vicinity of the University, three hours per week, second semester.—Professors ROWE and TERRELL.

Swarthmore College, Swarthmore, Pennsylvania

Roads and Building Materials.—Lectures, recitations and laboratory tests. The lectures and recitations deal with the construction of roads and pavements. The value of different materials, cost, upkeep, etc., with specifications, proper proportions, methods of inspection and testing. The laboratory work consists of tests of sands, mortars, cement, concrete, brick, etc. Texts, Byrne's *Highway Construction* and Carpenter's *Experimental Engineering*.—JOSEPH SWAIN, President.

Thayer School of Civil Engineering, Hanover, New Hampshire

A brief technical course is given on the theory and practice of highway construction, using for this purpose Baker's *Roads and Pavements*. The time devoted to it is less than thirty half-days, and instruction is given by consecutive recitations from the textbook. Our work in surveying covers all the necessary features of highway surveying in another connection entirely apart from this textbook course. We have the usual laboratory for testing materials, and thorough courses on materials of construction, cement, concrete, reinforced concrete (theory) and concrete structures, including culverts and bridges. Ordinary wooden and steel bridges are studied by text-book (in a separate course) as to analysis of stresses; and by inspections and designing, as to details. Assigning to a highway course all of the time given to details and constructive features in other connections would give an actual program requiring at least forty to forty-five half days.—ROBERT FLETCHER, Director.

Throop College of Technology, Pasadena, California

The prescribed course in highway engineering for civil engineering students consists of one recitation a week during the first half of the third year. The work covered includes: the design, construction, and maintenance of country roads and city streets, with special attention given to bituminous construction; specifications; methods of financing, and assessment of costs. Highway structures are studied under bridge design.—FRANKLIN THOMAS, Associate Professor of Civil Engineering.

Tufts College, Massachusetts

Highways.—The course is conducted by lectures, recitations and laboratory work during three hours per week for a half year. It includes drainage foundations; earth and broken stone roads; paving material, including asphalt and concrete; use of dust palliatives; cleaning and sanitation; pipe systems; and road machinery. Laboratory tests are made on sand, cement and paving material.

Office and field work comprise the preparation of plan and cross sections from survey notes of an existing unimproved road; location of a highway from contour plan; actual survey, design and mapping of streets including determination of proper grades at street intersections; inspection of roads. Text-book: *American Civil Engineers' Pocketbook*.—GARDNER C. ANTHONY, Dean Engineering School.

University of Alabama, Tuscaloosa, Alabama

The four-year civil engineering course has been revised and made to include the subjects of road location and construction, paving materials, pavement construction, the design of highway culverts and bridges and the testing of road materials, most of which subjects have in the past been open to special students in highway engineering only. In addition, a two-year course has been inaugurated, which is planned to prepare the students for the positions of superintendent of road and pavement construction. In addition to the fundamental studies of the regular four-year courses this course includes the subjects of general geology, petrology, steam and other engines, masonry, roads and pavements, and other technical subjects.

The road materials laboratory, in connection with the physical and cement testing laboratories, the geological department of the University, and the State Geological Survey Collections and equipment, is intended to afford facilities for the study of the road materials of Alabama and to furnish students with a research laboratory as well as instruction in the physical properties and usefulness of the various kinds of roads materials. GEO. JACOB DAVIS, JR., Dean.

University of Arkansas, Fayetteville, Arkansas

A four-year course leading to the degree of bachelor of civil engineering with special mention in highways. The first two years are quite similar to the regular course in civil engineering. For the junior and senior years, some special courses in highway engineering are substituted for subjects of less importance to highway engineers. Two hours per week in the road materials laboratory are required for the senior year. The vacation of the junior year is spent under the direction of the State highway engineer, the student being allowed actual expenses. The following is required of the students in the regular course in civil engineering.

Roads and Pavements.—Primarily for third year students in civil engineering. Required of all candidates for degree in civil engineering. The location, construction and maintenance of earth, macadam, telford, and sand-clay roads. Pavements for city streets. A two-hour course for one year.

Laboratory.—Testing of road materials. Fourth year students. One hour for half year.—J. J. KNOCH, Professor Civil Engineering.

University of California, Berkeley, California

Instruction in highway engineering is given in two courses: a lecture and a laboratory course. The lecture course is given by Prof. Charles Gilman Hyde. The laboratory course is offered under the joint direction of Prof. ARTHUR C. ALVAREZ and Prof. HORACE S. GRISWOLD.

Lecture Course.—The lecture course is known as "highway engineering," (course C. E. 106) and is elective in the junior and senior years for all students in the railroad and irrigation engineering courses. It is prescribed in the junior year for all students in sanitary engineering. The course embraces two lectures per week during one term of fifteen weeks, and deals with road and pavement economics; location; construction and maintenance of earth, gravel and broken stone roads, both with and without the use of bituminous and other materials; design, construction and maintenance of pavements; text is Blanchard and Drowne's *Highway Engineering*. The course requires three mid-term written reviews and a final written examination.

Laboratory Course.—The laboratory course covers testing of rock, oils, asphalts and paving brick. Laboratory work covers two 4 hour periods per week for a term of fourteen weeks.—Professors HYDE, GRISWOLD and ALVAREZ.

University of Georgia, Athens, Georgia

The regular four-year course in civil engineering offers a three hour per week option in highway engineering with additional work in road material laboratory and field surveys.

A good roads department is in operation for road extension work under three officers, one of them employed constantly in the field offers advice and assistance by correspondence and by visits to Georgia counties—makes examination of road materials free of cost; makes surveys for relocations and bridge sites; prepares designs for bridges and culverts upon request;

prepares specifications and legal advertisements for bridge lettings; inspects bridges in advance of acceptance; inspects dangerous structures; makes public addresses; offers a special ten-day course at Athens for road officials; offers a one-year course on highways to mature men contemplating employment as road officers.—C. M. **Strahan**, Dean, School Civil Engineering.

University of Idaho, Moscow, Idaho

In the civil engineering course a two-credit course for one semester is given on roads and pavements, requiring two class periods per week of recitation, lecture, drawing or field work. Instruction necessary for a highway engineer is given in connection with many other courses, such as surveying, drafting, testing laboratory, and structural engineering. The Department with the assistance of the U. S. Office of Public Roads, carried out the program of a short school for road overseers, March 12–14, 1913.—C. N. **Little**, Dean.

University of Illinois, Urbana, Illinois

The special instruction in highway engineering consists of two recitations per week for eighteen weeks in the third year, using Baker's *Roads and Pavements* as a text-book; and in his senior year the student may elect one-third of this work in subjects immediately connected with wagon roads and bridges.—**Ira** O. **Baker**, Professor of Civil Engineering.

University of Kansas, Lawrence, Kansas

The course of highway engineering is a half-year's work in roads and pavements in the junior year, in addition some little work is done in a small laboratory for testing road materials.—R. B. H. **Begg**, Professor of Engineering.

University of Maine, Orono, Maine

Highway Engineering.—(1) Municipal engineering, a two-unit course offered in the third year, embracing city planning, economics, drainage, construction and maintenance of pavements, sewerage and water supply; (2) highway engineering, a two-hour course for the fourth year on location, re-location, drainage, construction and maintenance of country roads and highways, highway economics, legislation and administration; (3) road material testing, a one-unit course for the fourth year for the testing of bituminous and non-bituminous road materials; (4) highway design, a one-unit drafting room course for the fourth year including map reconnaissance for a highway 12 to 15 miles in length, final location, profiles, establishment of grades, culvert design, estimate of cost, etc.

A complete laboratory equipped with the latest types of road materials testing machinery has been provided jointly by the Maine State highway commission and the University, and is located at the University where the tests for materials used in State highway work are performed. Other laboratories of the College of Technology are also utilised for testing required by the State commission.

University of Michigan, Ann Arbor

Highway Engineering. Two hours both semesters. Road economics and management. Location, construction and maintenance of country and suburban roads. Grades for pavements and roads, estimates of cost, street railway construction in paved streets, materials for paving, brick, asphalt, stone, wood and bituminous paving, foundations, road and pavement economics. This course is required of all civil engineering students.

Advanced Highway Engineering. Two hours, second semester only. A seminary course in highway engineering taking up a study of the most recent literature on the general problems of good roads, especially outside of large cities; State aid laws; State highway organizations.

Highway Laboratory. Two hours both semesters. Testing of cement, analysis of sand and gravel for concrete road construction, tests of rock for road building, including hardness, toughness, abrasion and cementation. Tests of paving brick. Study and tests of bituminous materials for road binders and of asphalt paving compositions.

Equipment.—The University has a fully equipped highway laboratory. The laboratory is practically a duplicate of the Washington laboratory of the Office of Public Roads, Department of Agriculture. In addition to the above the University offers a number of courses of study in subjects closely allied to highway engineering such as engineering contracts and specifications, municipal engineering, public utilities, mechanical handling of material, testing material, lithology, etc.—HENRY E. RIGGS, Professor of Civil Engineering; WILLIAM C. HOAD, Professor of Sanitary and Municipal Engineering; JOHN J. COX; Instructor in Highway Engineering.

The University of Minnesota, Minneapolis, Minnesota

A course is given in roads and pavements in the first semester of the junior year. During the first half of the semester, work consists of recitations and lectures on road location and construction. Many problems and reference readings on actual practice of construction are assigned. In the second half of the semester inspection of work in progress on the roads tributary to the Twin Cities and of pavements being laid in the cities is made. Both the asphalt and timber creosoting plants of Minneapolis are visited by the students. In the new Experimental Engineering Buildings a road testing laboratory has been established and some valuable new apparatus has recently been installed. Mr. E. B. Smith, Chief of the Roads Laboratory at Washington, D. C., was detailed to spend two weeks in this laboratory in order to standardize the practice here with that in the Washington laboratories. The general course in civil engineering includes surveying, methods of computing earthwork, masonry and steel structures, hydraulics, geology, economics of transportation, etc.—FRANCIS C. SHENEHON, Dean.

University of Mississippi, Oxford, Mississippi

A lecture course in highway engineering extends over two terms, class meets three times each week. Laboratory work, testing road materials is carried on in connection with this course. Another course, in road surveying ing and estimating occupies one term-three periods each week.

In a course in reinforced concrete, special attention is given to design of bridges and culverts, design of waterways being considered in connection with drainage engineering and sewerage. Other related subjects, as masonry and structural engineering, are treated by lectures and laboratory experimentation.—J. H. DORROH,

University of Missouri, Columbia, Missouri

The courses in highway engineering are as follows: Roads and pavements an elementary course given by recitations from textbook supplemented by lectures, two periods per week for one semester. Required of all students in civil engineering. Highway engineering, a more advanced course, conducted mainly as seminar work, references are given to sources of information, and reports required of the students on various assigned topics with discussion before the class. Two periods per week for one semester. Elective to students who have had the first course. Road materials comprising text-book study of bituminous materials, with a laboratory course covering the ordinary tests of rock for road purposes, and of bitumens. One period a week for one semester. Elective. Highway structures, a design course, comprising design of culverts and small bridges, mainly in concrete, including a reinforced concrete arch. Two periods a week for one semester. Elective for seniors.—F. P. SPALDING, Professor of Civil Engineering.

Montana State College, University of Montana, Bozeman Montana

Highway Engineering.—A course of highway engineering is given during the first semesters and deals with the location, construction and maintenance of highways. Water, salts, emulsions, tars, and bitumens as binders and dust preventatives. Tests of highway materials. Traffic data in relation to type of road. Methods of drainage, including types of culverts and area of water way. Patented types. Federal, State and county aid. Highway laws. A study of traction, sanitation, radiation of light and heat, slipperiness, ease of cleaning, repairing, etc. This course is laid out for students in civil engineering.—A. W. RICHTER, Dean.

The University of Nebraska, Lincoln, Nebraska

Roads and Pavements.—A course of readings, lectures and recitations covering the location, alignment, drainage construction and maintenance of earth, sand-clay, gravel, macadam, telford, brick, wood-block, concrete and bituminous roads. Modern methods of dust prevention are studied under maintenance.

Testing Road Materials.—Lectures and laboratory. This is a study of various kinds of road making materials; first semester, non-bituminous; second, bituminous; the laboratory being equipped for the usual tests.

Cement and Concrete Testing.—Lectures and laboratory. Classification, composition, manufacture, inspection and sampling of cements. Specifications for mixing and using. Practical testing of cement mortars and concretes. The laboratory is equipped for making all the standard tests.—GEO. R. CHATBURN, Professor of Applied Mechanics in charge of Highway Engineering.

University of Nevada, Reno, Nevada

The course occupies two class periods and two laboratory periods per week for one semester of eighteen weeks and the time devoted to highway engineering and closely related subjects occupies about thirty to forty per cent of that devoted to the total course.

The class treatment is based largely on Baker's *Roads and Pavements* with reference readings from government and other recent pamphlets.—H. P. BOARDMAN, Professor of Civil Engineering.

University of Notre Dame, Notre Dame, Indiana

The course, highway engineering, is given to the students in the civil engineering department and is completed in the senior year when it is studied four hours a week for sixteen weeks. The class-room work comprises recitations, the subject matter of which is carefully studied and prepared from approved text-books bearing on this subject; all of which is supplemented by lectures and explanations of the practical methods of road and street construction.

The study includes the subject matter of location of highways, and all the features that affect location; the methods and importance of thorough drainage are given special consideration; the effect on traffic of grades and improper location is estimated; the most approved methods of construction and the practical details in road making are then considered. The evident purpose of this study is to enable the student to intelligently locate and supervise the construction of highways so as to subserve the best interests of the community and to secure for the outlay the greatest possible benefit.

Next in importance are the materials used in road and street construction. These are studied and examined in accordance with the use and purpose which they serve. Paving materials are studied as to their wearing properties, strength and relative merits of different kinds, and the qualities that make for suitability; methods of testing and properties determined from tests. Instruction is given for making plans, profiles, and estimates of cost of construction; practice in specification writing. The economic benefits to communities of having better and improved highways are considered. Maintenance and the methods for securing proper maintenance are emphasized. Field work comprises the necessary surveys for preparing plans, profiles, estimates, specifications, etc. Visits of inspection are made and notes of construction taken, as also observations of condition of street pavements and faulty constructions noted; investigations of methods used to restore street surfaces and comparisons made.—M. J. McCue.

University of Oklahoma, Norman, Okla.

Four hours a week in the second half of the Sophomore year are devoted to roads and pavements. Instruction is based on text book work, supplemented by lectures and assigned readings. A considerable number of problems are solved covering estimates for various improvements, grading, masonry quantities, culvert design, etc. A problem or two in re-locating roads upon contour maps is undertaken. The selection of pavements is discussed with particular emphasis upon southwestern climatic conditions. The department has a 1911 Brick Rattler, and conducts numerous tests of paving brick for the cities and towns of the state. Work in concrete design and cement and concrete testing are handled in other materials courses. —James I. Tucker, Director.

University of Pennsylvania, Philadelphia, Pennsylvania

Two hours a week for the first half of the senior year are devoted to the subject of roads and pavements. The instruction in this subject is based on a text-book, supplemented by lectures. For purpose of recitations the class is divided into sections and frequent written tests are held. No special course in the testing of road materials is offered, but three hours a week for half of the senior year are devoted to tests of cement and concrete and three hours a week for half of the junior year to the testing of the materials of construction in general, including stone, wood, paving brick, etc.—Edgar Marburg, Professor-in-Charge.

University of Pittsburgh, Pittsburgh, Pennsylvania

Roads and Pavements.—A study of the location, width and transverse section of roads and streets, together with a study of the materials used and methods of constructing, repairing and improving the surfaces of roads and pavements. Two recitations of one hour each from an assigned text and collateral reading with three hours laboratory work per week for the last term (twelve weeks) of the senior year; required of all civil engineering students. The laboratory work included determination tests of the various properties of road materials, the efficiency of binders and dust preventives.—F. L. BISHOP, Dean.

University of the South, Sewanee, Tennessee

Highway engineering is covered briefly in the junior following a course in railroad construction and economics. Special attention is given to proper methods of construction of Highways with sand, clay, and macadam. —BEN COULSON, Head of the Department of Engineering.

University of Southern California, Los Angeles, California

The course in highway engineering is given in the last half year of the four year course in civil engineering. It consists of two hour periods per week of recitations based on Baker's *Highway Engineering*, and is supplemented by readings and lectures on allied subjects. Observations of methods of construction are made on the work of the Los Angeles County good road system and of the work of the State highway commission.—C. W. LAWRENCE, Professor of Civil Engineering.

University of South Carolina, Columbia, South Carolina

Roads and Pavements.—Lectures and recitations on the principles of road location; the construction and maintenance of earth, gravel, sand-clay and macadam roads; pavements for city streets and sidewalks. The class is given practical problems in road location and construction. First term, three hours per week.

Dust Preventives.—This course comprises five lectures, the study of standard authors, field observations and a written report covering the range of the subject. Reading matter will be assigned to the students at the end of their second year, and the five lectures will occur during the first term of the third year.—M. G. HOMES, Professor of Engineering.

University of Tennessee, Knoxville, Tennessee

The two months short course for highway engineers was inaugurated in 1914. Instruction was given in mathematics, mechanical drawing, surveying, highway engineering, cement testing and elementary mechanics.

The school for good roads was conducted four days in which lectures were given in road building, selection of routes, establishing grades, selection of road covering, etc. Instruction was planned to meet the needs of the county engineers and road supervisors.

University of Texas, Austin, Texas

The course in highway engineering deals with the location, construction and maintenance of roads, streets and pavements; the economy of good roads with their advantages, the methods of maintaining roads and their economical management. The instruction is given in the spring term of the junior civil engineering, three hours per week.—T. U. TAYLOR, Dean of Engineering.

University of Utah, Salt Lake City, Utah

The course given in roads and pavements covers two hours' recitation work per week and Baker's *Roads and Pavements* is used as a basis for the course. Reports are required of students from the current engineering magazines and the reports of the engineering societies.—R. B. KETCHUM, Professor of Engineering.

University of Vermont, Burlington, Vermont

The instruction in highway engineering comprises a three-hour course given in the second half of the senior year. It covers textbook and lecture work accompanied by laboratory work in testing of road materials, and field work in road surveys, the laying out of work, plans, estimates and specifications. A new modern laboratory with a complete equipment has just been installed for this work.—J. W. Votey, Dean.

University of Washington, Seattle, Washington

Four courses directly relating to highway engineering are given in the University of Washington. A brief outline of these courses follows.

Course 70: Highways.—This is a course of two hours per week running through a semester and required of all juniors in civil engineering. It covers a general survey of the location, construction and maintenance of country roads and city streets, and a study of alignment and grades in comparison with the same subjects as applied to railroad work. The study of drainage, foundations and methods of construction of the cheaper roads of earth, sand, clay and gravel occupy about two-thirds of the time given to this subject. Some of the fundamental economic principles involved in financing highways are discussed and emphasized.

Course 71: Highway Construction.—This is a course of four hours per week for one semester for the seniors in civil engineering who desire to specialize in highway work. The course deals more fully with the economics of highway location, construction and maintenance and involves the consideration and study of highways of permanent character. Each student is expected to perform all the standard laboratory tests of highway metals.

Course 72: City Streets and Pavements.—A two-hour elective course for students specializing in municipal and highway work. Devoted to a study of city streets and pavements, including estimates and inspection; also, a study of the manufacture and testing of the highest class of paving materials.

Course 18: Road Oils and Tars.—This is a two hour course throughout a semester and is offered by the department of chemistry for students in highway engineering. One lecture and one laboratory period are devoted to the work. It involves a study of the compostion and properties of all road binding materials.—Wm. F. Allison, Professor of Municipal and Highway Engineering.

University of Wisconsin, Madison, Wisconsin

Roads and Pavements 101.—This course covers the construction, maintenance and administration of earth roads, gravel roads, and the simpler forms of macadam road. Special attention will be devoted to the Wisconsin highway laws. Lectures, theme writing and inspections. One hour credit. Second semester.

Roads and Pavements 102.—Economics and design of roads and pavements The text is Blanchard's "Highway Engineering." Library work, reports and theme writing on assigned subjects are also required. Topics covered are history of roads and pavements; economics of highway engineering; preliminary investigations, traffic census, drainage, foundations, general design of roads and streets, hygienic aspect of dust, cleaning city streets, effect of various kinds of vehicles on roads, etc., bituminous surfaces and bituminous pavements, macadam, brick, stone, wood block and cement pavements. This course is offered each semester. Three-hour credits.

Roads and Pavements 103.—Special and detail study is made of the most important problems involved in the construction and maintenance of roads and pavements. Inspection trips are made to neighboring cities. Each student prepares a design and estimate of cost of some road or street based upon a survey or a topographic map furnished him. Given each semester. Three hour credits.

Roads and Pavements 104.—This course consists of laboratory work on testing road material both in the chemical and pavement laboratories. Two credits. Second semester.—Prerequisite for this course is Course 102 or its equivalent. Three-hour credits.

Highway Bridges and Culverts 111.—Lectures and problems in design work covering the standard types of pipe, box and arch culverts, and also standard types of wood, steel, concrete and reinforced concrete bridges. Two-hour credits.—LEONARD S. SMITH, in charge of Highway Engineering.

University of Wyoming, Laramie, Wyoming

Roads and Tunnels.—(a) Road economics and location, gravel, broken stone, and miscellaneous roads; street pavements, drainage, curbs and gutters, pavement foundations, asphalt, brick, cobblestone and stone-block pavements; sidewalks. Two hours. (b) Methods of surveying, tunnel machinery, timbering and lining, tunnels through hard rock and soft ground submarine tunneling, ventilation and lighting, cost of construction. Two hours.

Virginia Polytechnic Institute, Blacksburg, Virginia

Roads and Building Material.—A special set of lectures, with illustrations, is given upon the general and detailed construction of roads, city and country, pavements and drains, cost, grades, repair, etc. The points emphasized in these lectures are: Different road coverings and the best materials available for use and economy, the inspection and testing of sands, cements and mortars, their actual mixing, proper proportions, etc., with specifications and requirements for good building materials, tests and demonstrations of the peculiarities of the different road materials, with short course in concrete. Textbook, Baker's *Roads and Pavements* Harger and Bonney's *Highway Engineer Handbook.* Three times a week second term. In connection with this course is given a short course in curves, earth-work and calculating cuts and fills. Lectures on available instruments for use in building highways and comparative costs.—R. B. H. BEGG, Professor of Civil Engineering.

Washington University, St. Louis, Missouri

Roads, Streets and Pavements.—The location, drainage, construction and maintenance of streets and roads; consideration of the different paving materials in connection with their particular characteristics and their adaptability and adequacy under various conditions of service; the cost and life of pavements. Two lectures a week. First semester. Senior year.—J. L. VAN ORNUM, Professor of Civil Engineering.

West Virginia University, Morgantown, West Virginia

The following courses in highway engineering are regularly given in the department of railway and highway engineering: Roads and pavements, primarily for fourth year students in civil engineering, three hours. Required of all candidates for degree in civil engineering. Location, construction and maintenance; study and comparison of various types of roads; road making materials; lectures, recitations and field work. Highway economics two hours. Optional for fourth year students in civil engineering.

Continuation of roads and pavements with special reference to permanent improvements and maintenance of existing roads. Re-surveys, re-location, drainage, etc.

The course in roads and pavements is required of all candidates for degrees of civil engineering, but for the course of highway economics the student may substitute the equivalent in hydraulic construction if he so elects. These courses follow thorough courses in surveying, railroad location, railroad construction and maintenance and accompany courses in sanitary and water supply engineering, in which the problems relating to sewerage and drainage are considered, so that the courses in highway engineering are concentrated on the special problems to be met in the building of roads not common to other subjects.

An optional laboratory course in testing road material is given and graduate courses in highway engineering are offered.

A ten day school of good roads, of which A. D. Williams, chief engineer of the State bureau of roads is director, has been organized to comply with the act of the legislature requiring that "All county road engineers shall visit the office of the State Road Bureau at least once every year and shall receive instruction in road building for at least ten days. etc." This school is under the joint supervision of the University and the State road bureau. The first and second annual sessions were well attended and highly successful. Tuition is free.—C. R. Jones, Dean.

Worcester Polytechnic Institute, Worcester, Massachusetts

The course in highway engineering given students in civil engineering consists of reading, recitations and lectures for one-half year, one period per week. All students taking the course have had thorough courses in surveying, railroad surveying and construction, masonry and foundations and later take courses on bridges, sewers and drains. Much of the important subject matter on road construction is taken in these subjects, but not formally as a course in highway construction.—A. W. French, Professor of Civil Engineering.

TRADE NAMES

Road Materials

Acme Asphalt: Trade name given to asphalt cement produced by Warren Brother Company, 59 Temple Place, Boston, Massachusetts.

Agasco: A refined road tar manufactured by the Atlanta Gas Light Company, Electric and Gas Building, Atlanta, Georgia.

Armco American Ingot Iron: Pure iron for rust resisting culverts. American Rolling Mill Company, Middletown, Ohio (advertisement page 188).

Asfaltoil: Gulf Refining Company, 514 Battery Park, New York, New York. The trade name for several grades of fluid reduced petroleums for use in the surface treatment of roads.

Asphaltoilene: Alden Speare's Sons Company, Boston, Massachusetts. The trade name of several grades of reduced and residual petroleums and oil asphalt manufactured by this company for use in hot and cold surface treatment and in the construction of roads.

Asphalt Block: For pavements. The Hastings Pavement Company, New York City (advertisement page 175).

Astec: United States Asphalt Refining Company, 90 West Street, New York, New York. An asphalt produced from Mexican maltha (advertisement page 197).

Bermudez Road Asphalt: Barber Asphalt Paving Company, Philadelphia, Pennsylvania. Fluxed Bermudez Lake asphalt for use in road construction (advertisement page 162).

Bicomac: Headley Good Roads Company, 30th and Spruce Streets, Philadelphia, Pennsylvania. An emulsified bitumen which is diluted with water and mixed with Portland cement concrete in the surfacing of roads (advertisement page 177).

Bitulithic: Warren Brothers Company, 59 Temple Place, Boston, Massachusetts. Trade name of a patented pavement construction consisting of varying sizes of crushed stone or gravel mixed with bituminous cement, the sizes of crushed stone varying from a maximum which is about one-half the depth of the pavement surface (which surface is generally 2 inches deep) to impalpable powder, being so prepared as to give a high degree of density and low percentage of voids (advertisement page 202).

Bitustone Double Bond: A pavement construction patented by August E. Schutte of Northboro, Massachusetts, consisting of a concrete foundation of a depth of about 3½ inches, and bonding course about 1½ inches and the spaces in the bonding course filled and the surface coated with asphaltic cement, prepared for the purpose, the surface finally finished with crusher screenings or coarse sand spread into the hot bitumen The bonding course is made of neat cement and nearly uniform size stone or gravel (preferably 1 inch to 1½ inches in size), in proportion of one part cement to six parts stone or gravel (advertisement page 202).

Byerlyte: Byerley & Sons, 2484 West Fourth Street, Cleveland, Ohio. Several grades of oil asphalt for use in road construction.

Carbo-Via: Continental Bitumen Company, Toledo, Ohio. A refined coal tar product for use on tar bound macadam.

Chelreco: Chelsea Refining Company, Tulsa, Oklahoma. Several grades of fluid petroleum products for use as road oils.

Chicago AA: A Brand of Portland Cement manufactured by the Chicago Portland Cement Company, Chicago and Oglesby, Illinois (advertisement page 164).

Cubanel: International Asphalt Company, Chamber of Commerce Building, Chicago, Illinois. A fluxed Cuban asphalt for use in paving and road construction.

Double Bond Cement: Warren Brothers Company, 59 Temple Place, Boston, Massachusetts. Trade name given to the asphalt cement used for the bonding course of the Bitustone Double Bond Pavement (advertisement page 202).

Du Pont: Explosives for quarrying. E. I. du Pont de Nemours Powder Company, Wilmington, Delaware.

Durax: Wern Machinery and Engineering Company, 30 Church Street, New York, N. Y. The trade name for a type of pavement or road surface composed of small cubical granite blocks.

Dustoline: The Dustoline for Roads Company, Summit, New Jersey. The copyrighted, trademark name of a transparent, reddish colored compound, of refined, nonasphaltic petroleum products, used as a dust preventive and road preserver.

Fairfield: The Impervious Product Company, 400 E. Fayette Street, Baltimore, Maryland. The trade name for the products of this company, such as "Anti-Dust," "Road Binders," and "Fairfield Asphalt." The latter, which forms the basis of their other products, is said to come from a neutralized and weathered sludge acid deposit.

Glutrin: Robeson Process Company, 18 East 41st Street, New York City. An adhesive liquor containing organic acids manufactured from the lignone compounds produced in the making of wood pulp by the sulfite process (advertisement page 191).

Hassam Pavement: Hassam Paving Company, Worcester, Massachusetts. A patented form of concrete pavement constructed by grouting the rolled stone with a fluid grout of sand and Portland cement.

Hydrolene: The Sun Company, 1421 Chestnut Street, Philadelphia, Pennsylvania. Oil asphalts for use in road construction.

Indian: Indian Refining Company, 17 Battery Place, New York. The trade name for several grades of reduced and residual petroleums and oil asphalt for use in hot and cold surface treatment and in the construction of roads.

Kyrock: Wadsworth Stone and Paving Company, Lambert Street, and Penna. R. R., Pittsburgh, Pennsylvania. A natural rock asphalt found in Kentucky.

Lewis Road Tar: The F. J. Lewis Manufacturing Company, 2505 South Robey Street, Chicago, Illinois. A scientifically prepared coal tar product.

Monarch: Sunset Monarch Oil Company of California, 60 California Street, San Francisco, Calif. The trade name for a heavy oil.

Montezuma: Warner-Quinlan Asphalt Company, 79 Wall Street, New York, N. Y. Several grades of Mexican oil-asphalt for use in street and road construction (advertisement page 201).

National: Bituminized Road Company, Kansas City, Missouri. Trade name of a patented product which consists of earthy material of any kind and a bituminous binder. The earthy material is subjected to a disintegrating treatment, which reduces it to a fine, dry dust that renders it capable of absorbing and combining with the bituminous binder (advertisment page 165).

Neuchatel: The Neuchatel Asphalte Company, Ltd., 79 Tompkins Street, New York. A rock asphalt mined at the Val de Travers mines located at Canton of Neuchatel, Switzerland.

Progressive Culverts: Combination cast iron and corrugated iron, also pure iron culvert pipe. Manufactured by American Culvert Manufacturing Company, Buechel, Kentucky.

Readamite: National Roadamite Paving Supply Company, 2 and 3 H. W. Hellman Building, Los Angeles, Calif. The trade name for an asphaltic cement prepared from California petroleum.

Rocmac: Rocmac Road Corporation of America, Cleveland, Ohio. A chemical mixture containing silicate of soda, sugar, powdered limestone, and other ingredients with which the upper course in macadam or gravel construction is puddled.

Sarco: Standard Asphalt and Rubber Company, 208 South La Salle Street, Chicago, Illinois. Several grades of asphalt containing Gilsonite, for use in road construction.

Sarcolithic: Standard Asphalt and Rubber Company, 208 South La Salle Street, Chicago, Illinois. The trade name for a form of pavement consisting of a graded crushed stone aggregate which is mixed with Sarco Asphaltic Cement.

Standard: Standard Oil Company of New York, and Standard Oil Company of New Jersey, 26 Broadway, New York. "Standard Refined Mexican Asphalt," "Standard Macadam Asphalt Binders," "Standard Asphalt Road Oils," prepared by these Companies for use in sheet asphalt paving, bituminous macadam construction and cold surface treatment of macadam and gravel roads (advertisements pages 192 and 194).

Tarite: The American Tar Company, Malden, Massachusetts. A refined coal tar product for use in road construction. "Tarite Asphalt" is a refined coal tar containing a certain percentage of oil asphalt. "Tarine," a refined tar preparation for use in construction work or in surface treatments (advertisement page 154).

Tarvia: Barrett Manufacturing Company, 17 Battery Place, New York, New York. A trade name of this Company for their tar products used for road purposes. "Tarvia A" for hot surface treatment: "Tarvia B" for cold surface treatment: "Tarvia X" for penetration or mixing method in road construction (advertisement page 163).

Tasscoil: The Alden Speare's Sons Company, Boston, Massachusetts. A colorless oil distillate for use as a dust layer.

Terracolio: Headley Good Roads Company, Real Estate Trust Building, Philadelphia, Pennsylvania. An emulsified semi-asphaltic oil which may be diluted and used in the surface treatment of roads (advertisement page 177).

Texaco: John Baker, Jr., New York, Chicago, Boston, Philadelphia, Baltimore, Richmond, Birmingham, New Orleans, Buffalo, Albany, Minneapolis, Kansas City, Denver, Tampa and Toledo. All the Texaco road products are marketed under the registered trade name "Texaco." They are "Texaco Road Oil for Cold Application," "Texaco Road Oil for Hot Application," "Texaco Liquid Asphalt," "Texaco Macadam Binder," "Texaco Road Asphalt," "Texaco Paving Filler," "Texaco Paving Cement."

Trinidad Liquid Asphalt: Barber Asphalt Paving Company, Land Title Building, Philadelphia, Pennsylvania. Natural liquid asphalt for the surface treatment of roads, obtained from the Island of Trinidad; "A" to be used cold; "B" to be applied hot (advertisement page 162).

Ugite: The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania. The trade name for fluid and semi-solid refined water-gas tar for use in surface treatment and construction. "No. 1" is applied cold as a dust layer; "No. 2" is applied hot for surface treatment; "No. 3" is recommended for construction by the penetration method; "No. 4" is recommended for construction by the mixing method.

Union Paving Asphalt and Maltha Brand: Union Oil Company of California, Mills Building, San Francisco. Oil asphalt refined from heavy California crudes of between 12 and 16 gravity Beaume.

Warrenite: Warren Brothers Company, 59 Temple Place, Boston, Massachusetts. A modification of the bitulithic city pavement adapted to meet the traffic conditions of country roads (advertisement page 202).

Westrumite: The Westrumite Company, Whiting, Indiana: The Alantic Westrumite Company, Washington, D. C. An aqueous emulsion of native bitumens used cold as a binder in road construction in the following ways: (1) By mixing method (2) By penetration method (3) By surface treatment (4) As a dust layer.

Road Machinery

Acme: Trade name given road machines, stone crushers, scarifiers, elevator and portable stone bins manufactured by the Acme Road Machinery Company, Frankfort, New York.

Acme: Trade name given to metal nestable corrugated culverts manufactured by The Canton Culvert and Silo Company, Canton, Ohio.

Ajax: Trade name given to portable steam engines used for operating crusher plants manufactured by the A. B. Farquhar Company, York, Pennsylvania.

Apex: Reversible dumping and spreading car. Eagle Wagon Company, Auburn, New York.

Atlantic: Trade name given to steam shovels manufactured by the Bucyrus Company, South Milwaukee, Wisconsin.

Atlapump: Trade name given to a gasoline pumping engine manufactured by the Harold L. Bond Company, 391 Atlantic Avenue, Boston, Massachusetts.

Aurora: Trade name given to jaw rock crusher and dump wagon manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Austin: Trade name given to motor rollers, gyratory crusher, sprinkler and reversible grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Austin-Cube: Trade name given to concrete mixer manufactured by the Municipal Engineering and Contracting Company, Railway Exchange Building, Chicago, Illinois.

Austin Giant: Trade name given to grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Automatic Concrete Mixers: Gravity mixers, Haines-Weaver Patents. By Automatic Concrete Mixer Company, Inc., 50 Church Street, New York City.

Big Four Gas Tractors: Emerson-Brantingham Implement Co., Rockford, Illinois.

Blystone Batch Mixer: Concrete mixer. Manufactured by Blystone Manufacturing Company, Cambridge Springs, Pennsylvania.

Bucyrus: Trade name given to a steam shovel manufactured by the Bucyrus Company, South Milwaukee, Wisconsin.

Buffalo Pitts: Trade name given Ddl. Cyl. Two-Speed Steel Gear Road Locomotives, Contractors Special Traction Engines, Contractors Gasoline Tractors, Reversible Stone Spreading Cars—Steel Frame, Reversible Stone Spreading Cars—Wood Frame, Buffalo Pitts Road Freight Cars, and Automobile Trailers. Buffalo Pitts Company, Buffalo, New York.

Busy Bee: Trade name given to hammer drills manufactured by the Kiernan-Terry Drill Company, Woolworth Building, New York, New York.

Butterfly, Bull Moose, Electric-Air, Jackhamer, Leyner-Ingersoll, Sergeant: Trade name given to rock drills manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Calyx: Trade name given core drills manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Case: Steam rollers, gas and steam traction engines, road graders, drags. scrapers, rock crushers, elevators, screens, bins, etc. J. I. Case Threshing Machine Company, Racine, Wisconsin.

Caterpillar: A traction engine with endless steel belt, replacing wheels, giving additional traction in all soils. Holt Manufacturing Company, Peoria, Illinois (advertisement page 116).

Climax: Trade name given to a steel reversible road machine and a rock crusher sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 172).

Climax Jumbo: Trade name given a heavy road machine sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 172).

Columbian: Trade name given to dump wagons and carts manufactured by the Columbia Wagon Company, Columbia, Pennsylvania.

Crown: Trade name given to sand rammers manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Double Shell: Trade name given to dryers manufactured by the Ruggles-Coles Engineering Company, 50 Church Street, New York, New York.

Eagle Dump Wagon; *Eagle Two Wheel Trailers; Eagle Four Wheel Trailers:* The Eagle Wagon Works, Auburn, New York.

Electric-Air: Trade name given to rock drills manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Emerson Gas Tractors: Emerson-Brantingham Implement Co., Rockford, Illinois.

Eureka: Continuous concrete mixer, batch concrete mixers, mortar mixers, diaphragm pumping outfits. Eureka Machine Company, Lansing, Michigan.

Everett: Trade name given to portable dump wagon box manufactured by the Everett Manufacturing Company, Newark, New York.

Foote: Batch concrete mixer. Foote Manufacturing Company, Munda, New York.

Force-Feed: Trade name given to the rock crusher manufactured by the Universal Crusher Company, Cedar Rapids, Iowa.

Glide: Trade name given to graders manufactured by the Glide Road Machine Company, Minneapolis, Minnesota.

Huber: Road rollers, tractors, dump wagons, scarifiers and general road equipment. Huber Manufacturing Company, Marion, Ohio.

Hvass: Trade name given to scarifier, push brooms, street sweepers and general equipment for handling bituminous materials manufactured by the Chas. Hvass Company, East 18th and 19th Streets, Avenues A and B, New York, New York.

Imperial, Ingersoll-Rogler: Trade name given to air compressors manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Imperial: Trade name given air hoists and motors manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Imperial: Trade name given to riveted corrugated metal culverts manufactured by the Canton Culvert and Silo Company, Canton, Ohio.

Link: Conveyors for loading and unloading crushed stone, sand, etc., from cars or dump into wagons. Link Belt Company, Philadelphia, Pennsylvania.

Little David: Trade name given riveting and chipping hammers and pneumatic drills manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Little Western: Trade name given to grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Little Winner: Trade name given a two-horse road machine sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 172).

Lutz: Surface heater for heating asphalt pavements at time of repair. Equitable Asphalt Maintenance Company, Kansas City, Missouri.

Maney Four Wheel Scraper: Trade names given to grader and scraper manufactured by the Baker Manufacturing Company, Springfield, Illinois.

Milburn-Blatt: Trade name given to dump wagon manufactured by the Milburn Wagon Company, Toledo, Ohio.

Mogul: Trade name given to full line of oil burning engines and tractors sold by the International Harvester Company of America, Harvester Building, Chicago, Illinois (advertisement page 178).

Monarch: Trade name given a combination roller and traction hauling engine sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 172).

New Era: Trade name given to elevating grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Ohio: Road machines, scarifiers, gang rooter plows, subgrade levelers, wheelers, graders, drags, dump boxes. Ohio Road Machinery Company, Oberlin, Ohio.

Otto: Trade name given an engine manufactured by The Otto Gas Engine Works, 33rd and Walnut Streets, Philadelphia, Pennsylvania.

Panama Line: Trade name given to road graders, road drags and cast iron culvert pipe manufactured by the F. B. Zieg Manufacturing Company, Fredericktown, Ohio (advertisement page 207).

Peerless: Traction engines, steam road rollers. Emerson, Brantingham Implement Company, Rockford, Illinois.

Pennsylvania: Trade name given to crushers manufactured by the Pennsylvania Crusher Company, Philadelphia, Pennsylvania.

Pioneer: Trade name given to dump wagon manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Porcupine: Trade name, given a scarifier manufactured by the Universal Road Machinery Company, Kingston, New York (advertisement page 200).

Port Huron: Trade name given to hauling engines, spreading and dumping cars manufactured by the Port Huron Engine & Thresher Company, Port Huron, Michigan.

Port Huron: Trade name given a road roller manufactured by the Port Huron Engine & Thresher Company, Port Huron, Michigan.

Reeves Gas Tractors: Emerson-Brantingham Implement Co., Rockford, Illinois.

Reeves Traction Engines: Emerson-Brantingham Implement Co., Rockford, Illinois.

Reliance: Trade name given rock crusher elevators, screens, portable stone bins and improved street sweeper manufactured by the Universal Road Machinery Company, Kingston, New York (advertisement page 200).

Road King: Trade name given to a road grader and Adams Leaning Wheel Graders, manufactured by J. D. Adams & Company, Indianapolis, Indiana.

Simplex: Trade name given to batch and continuous concrete mixers manufactured by The Miles Manufacturing Company, Jackson, Michigan.

Simplified Continuous Mixer: Trade name given to concrete mixer manufactured by Besser Manufacturing Company, Alpena, Michigan.

Smith: Rotary batch concrete mixers. T. L. Smith Company, Milwaukee, Wisconsin.

Smith Chicago: Concrete mixer, batch type, rotary. Chicago Concrete Machinery Company, Milwaukee, Wisconsin.

Studebaker: Wagons, street sprinklers, sweepers and flushers, road oilers, dump wagons, boxes, carts, tank wagons, harness, automobiles, etc. Studebaker, South Bend, Indiana, and Detroit, Michigan.

Tarco: Trade name given to road oiling appliances manufactured by the Tarrant Manufacturing Company, Saratoga Springs, New York.

Telsmith: Gyratory and jaw crushers, rock, ore and gravel handling equipment. Smith Engineering Works, Milwaukee, Wisconsin.

Titan: Trade name given to full line of oil-burning engines and tractors sold by the International Harvester Company of America, Harvester Building, Chicago, Illinois (advertisement page 178).

The Big-an-Little: Trade name given to concrete mixers manufactured by the Jaeger Machine Company, Columbus, Ohio.

The Standard: Trade name given to a mixer manufactured by the Standard Scale & Supply Company, 243 Water Street, Pittsburgh, Pennsylvania.

The Susquehanna: Trade name given to a dump wagon manufactured by the Columbia Wagon Company, Columbia, Pennsylvania.

20th Century Grader: Trade name given to grader and scraper manufactured by The Baker Manufacturing Company, 906–907 Exchange Building, Memphis, Tennessee.

Vortex: Trade name given to pump engine manufactured by the Lawrence Pump & Engine Company, Lawrence, Massachusetts.

Vulcan: Trade names given to steam shovels manufactured by the Bucyrus Company, South Milwaukee, Wisconsin.

Watson: Dump wagons, trailers, etc. Watson Wagon Company, Canastota, New York.

Western: Trade name given to elevating grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Western Special: Trade name given to grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

Western Standard: Trade name given to grader manufactured by the Austin-Western Road Machinery Company, Karpen Building, Chicago, Illinois (advertisement page 160).

OFFICE OF PUBLIC ROADS, UNITED STATES DEPARTMENT OF AGRICULTURE

The Office of Road Inquiry was established under act of congress, approved March 3, 1893, making an appropriation of $10,000 for the Department of Agriculture.

The original law provided for making inquiries in regard to systems of road management, best methods of road making, preparation of publications, and for assisting agricultural colleges and experiment stations in disseminating information on the subject. In 1897 the investigation of road materials was authorized. In 1899 the name of the office was changed to "Public Road Inquiries." In 1901, provision was made for conducting experiments in the city of Washington and elsewhere. In 1902 investigations relating to the chemical and physical character of road materials were authorized. In 1905 the name of the office was again changed to "Office of Public Roads," and a statutory organization was provided. In 1909 the rent or purchase of road machinery was forbidden.

In 1910 the lump fund appropriation was subdivided into road management inquiries, road building and maintenance investigations, road material investigations and administrative expenses.

In 1911-12 a special appropriation of $10,000 was made for conducting field experiments and authority was given to rent or purchase machinery required in connection therewith. The appropriation for this work was increased to $30,000 for 1912-13, to $45,000 for 1913-14 and to $60,000 for 1914-15. The following is a table of appropriations from the establishment of the office to the fiscal year 1914-15 and includes the estimates reported by the committee on agriculture of the house of representatives for the fiscal year 1915-16.

Appropriations from 1893-4 to 1915-16

1893-94	$10,000	1905-06	$50,000
1894-95	10,000	1906-07	70,000
1895-96	10,000	1907-08	70,050
1896 97	8,000	1908-09	87,390
1897-98	8,000	1909-10	116,460
1898-99	8,000	1910-11	114,240
1899-1900	8,000	1911-12	160,720
1900-01	14,000	1912-13	212,120
1901-02	20,000	1913-14	279,400
1902-03	30,000	1914-15	352,560
1903-04	35,000	1915-16	586,465[1]
1904-05	35,000		
			$2,295,405

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[1] Changed to Office of Public Roads and Rural Engineering, July 1, 1915.

In the Post Office Appropriation Bill for 1912–13, an appropriation of $500,000 was made for coöperation with States in the improvement of post roads; conditioned upon the States expending $2 for each $1 expended by the Government, the roads to be constructed under the direction of the Secretary of Agriculture. In 1913–14 the appropriation for post roads was continued and made available until expended.

TABLES OF QUANTITIES, WEIGHTS AND MEASUREMENTS FOR USE IN ROAD WORK

Crushed Stone Required per Mile of Macadam Road

WIDTH, FEET	THICKNESS COMPACTED, INCHES	TONS OF STONE REQUIRED
8	4	875
	6	1,312.50
	8	1,750
	10	2,187.50
	12	2,625
9	4	984.37
	6	1,476.56
	8	1,968.75
	10	2,460.94
	12	2,953.12
10	4	1,093.75
	6	1,640.62
	8	2,187.50
	10	2,734.37
	12	3,281.25
12	4	1,312.50
	6	1,968.75
	8	2,625
	10	3,281.25
	12	3,937.50
14	4	1,531.25
	6	2,296.87
	8	3,062.50
	10	3,828.12
	12	4,593.75
15	4	1,640.62
	6	2,460.94
	8	3,281.25
	10	4,101.56
	12	4,921.87
16	4	1,750
	6	2,625
	8	3,500
	10	4,375
	12	5,250

Number of Square Yards in One Mile of Road

WIDTH, FEET	SQUARE YARDS
8	4,693.33
10	5,866.66
12	7,040
14	8,213.33
16	9,386.66
18	10,560

Cubic Yards of Gravel for Constructing One Mile of Road

WIDTH, FEET	THICKNESS COMPACTED, INCHES	CUBIC YARDS GRAVEL, COMPACTED	CUBIC YARDS GRAVEL, LOOSE
8	6	782.22	1173.33
	7	912.59	1368.88
	8	1142.93	1564.39
	9	1173.33	1760.00
	10	1303.70	1955.55
9	6	880.00	1320.00
	7	1026.67	1540.00
	8	1173.33	1760.00
	9	1320.00	1980.00
	10	1466.66	2200.00
10	6	977.77	1466.65
	7	1140.74	1711.11
	8	1303.70	1955.55
	9	1466.67	2200.00
	10	1629.63	2444.44
12	6	1173.33	1760.00
	7	1368.88	2053.32
	8	1564.44	1346.66
	9	1760.00	2640.00
	10	1955.55	2933.32
14	6	1368.88	2053.32
	7	1597.04	2595.56
	8	1825.19	2737.78
	9	2053.33	3079.99
	10	2281.44	3422.16
15	6	1466.67	2200.00
	7	1711.11	2566.66
	8	1955.55	2933.32
	9	2200.00	3300.00
	10	2444.44	3666.66
16	6	1564.44	2346.66
	7	1825.19	2737.78
	8	2085.93	3128.89
	9	2346.67	3520.00
	10	2607.41	3911.11

ROAD ASSOCIATIONS

Permanent International Association of Road Congresses

Officer.—M. Mahieu, secretary-general, 1 Avenue d'Iena, Paris, France.

1. Object and Organization of the Association

ARTICLE I

The object of the Permanent International Association of Road Congresses is to promote progress in the construction, traffic and exploitation of roads.

It continues the work of the first International Road Congress held in Paris in October, 1908.

It accomplishes its object: 1, By organising Road Congresses; 2, by publishing papers, proceedings, and other documents; 3, by collecting the results of (*a*) tests carried out on roads; (*b*) laboratory tests throughout the world on materials which are used or are suitable for road construction and maintenance; these tests may be either in the form of mere records collected by the Association or they may have been carried out by the Association itself or through its instrumentality.

Its affairs are managed by a Permanent International Commission.

ARTICLE II

The Association consists of:

1. Delegates of Governments and Corporations of all the countries which subscribe annually to the Association.

2. Private Members.

Membership may be either permanent or temporary.

Governments may appoint one official delegate, with a right to vote at every Congress, for each 250 francs of their annual subsidy.

This amount is reduced to 100 francs for Corporations.

Permanent Members are entitled to attend and vote at every Congress.

Temporary members are entitled to attend the particular Congress they have joined, and they may vote on all questions which do not affect the Permanent Association itself.

3. Honorary Members, nominated by the Permanent International Commission.

ARTICLE III

1. A Permanent International Commission, with headquarters at Paris, is at the head of the Association.

2. A Permanent Council and an Executive Committee are appointed from amongst the Members of this Commission.

ARTICLE IV

The Permanent International Commission is composed of members belonging to the various countries represented in the Association. Each country has the right to one representative for each 1000 francs of its total annual subsidy.

Provided, however, that the number of representatives from any one country shall not exceed 15 (fifteen), and that any country which pays not less than 250 francs shall have the right to appoint one delegate.[1]

American Highway Association

Officers.—Fairfax Harrison, president Southern Railway Company, president; Logan Waller Page, director Office of Public Roads, vice-president; John Burke, treasurer of the United States, treasurer; James S. Harlan, chairman Interstate Commerce Commission, chairman board of directors; Leonard Tufts, president Capital Highway Association, chairman executive committee; I. S. Pennybacker, executive secretary, Colorado Building, Washington, D. C.; Charles P. Light, field secretary, Colorado Building, Washington, D. C.

Headquarters.—708 Colorado Building, Washington, D. C.

American Road Builders' Association

Officers.—W. A. McLean, president, Toronto, Canada; E. L. Powers, secretary, New York; W. W. Crosby, treasurer, Baltimore, Maryland.

Headquarters.—150 Nassau Street, New York.

American Association of State Highway Officials

Officers.—Henry G. Shirley, president, Baltimore, Md.; Austin B. Fletcher, vice-president, Sacramento, Calif.; Joseph Hyde Pratt, secretary, Chapel Hill, N. C.; F. F. Rogers, treasurer, Lansing, Mich.

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[1] For further information address either the secretary general or the American Highway Association.

Association of State Highway Departments

Officers.—A. R. Hirst, president, Madison, Wis.; W. S. Gearhart, secretary-treasurer, Manhattan, Kan.

American Society of Engineering Contractors

Officers.—Howard J. Cole, president; Edward Wegmann, first vice-president; George T. Clarke, second vice-president; J. R. Wemlinger, secretary, 11 Broadway, New York.

Committees.—B-10, Standard Specifications for Paving Materials, George C. Warren, chairman, 59 Temple Place, Boston, Massachusetts; C-7, Highway Construction; F. B. Bosch, chairman, Commonwealth Trust Building, Harrisburg Pennsylvania; C-8, Highway Maintenance; Carl Weber, chairman, 95 Nassau Street, New York; C-11, Bridges; Daniel B. Luten, chairman, Traction Terminal Building, Indianapolis, Indiana.

Association of Engineering Societies

Officers.—Jos. W. Peters, secretary, 3817 Oline St., St.Louis, Missouri. Board of managers: Gardner S. Williams, chairman, Ann Arbor, Michigan.

Purpose.—The association exists for the purpose of publishing papers, sent in by the secretaries of the local societies, on technical subjects, including road building, but does not take the execution of work.

Automobile Chamber of Commerce

Officers.—Charles Clifton, president; W. C. Leland, first vice-president; Hugh Chalmers, W. T. White, P. H. Rice, second vice-presidents; R. D. Chapin, secretary; George Pope, treasurer; S. A. Miles, general manager, 7 East 42d Street, New York; H. A. Bonnell, assistant general manager.

American Automobile Association

Officers.—John A. Wilson, president, Franklin, Pa.; George C. Diehl, chairman good roads board, 575 Ellicott Square, Buffalo, N. Y.; A. G. Batchelder, chairman executive board, Riggs Building, Washington, D. C.

National Headquarters.—437 Fifth Avenue, New York City.

National Capitol Headquarters.—Riggs Building, Washington, D. C.

American Society of Civil Engineers

Officers.—Hunter McDonald, president; Charles Warren Hunt, secretary.

Headquarters.—220 West 57th Street, New York.

Purposes so far as they relate to roads.—Investigation and discussion of technical problems of road construction and maintenance.

American Society for Testing Materials

Officers.—A. N. Talbot, president, University of Illinois, Urbana Ill.; Edgar Marburg, secretary-treasurer, University of Pennsylvania, Philadelphia, Pennsylvania.

Committees.—On Standard Specifications for Cement: George F. Swain, chairman, Harvard University, Cambridge, Massachusetts Richard L. Humphrey, secretary, 805 Harrison Building, Philadelphia, Pennsylvania.

On Standard Specifications for Brick: A. V. Bleininger, chairman, 40th and Butler Streets, Pittsburgh, Penna.; D. E. Douty, secretary, 340 Hudson Street, New York City.

On Standard Specifications and Tests for Clay and Cement Sewer Pipe: Rudolph Hering, chairman, 170 Broadway, New York; E. J. Fort, secretary, 215 Montague Street, Brooklyn, New York.

On Standard Tests and Specifications for Drain Tile: A. Marston, chairman, Iowa State College, Ames, Iowa.

On Standard Tests for Road Materials: Logan Waller Page, chairman, Office of Public Roads, Washington, D. C.; Prevost Hubbard, secretary, Institute of Industrial Research, Washington, D. C.

Canadian Highway Association

Officers.—Hon. Thomas Taylor, Minister of Public Works, B. C., honorary president; W. J. Kerr, president, New Westminister, B. C., Frank E. Mutton Toronto, Ontario, vice-president; P. W. Luce, New Westminister, B. C., secretary; T. S. Baxter, Vancouver, B. C., treasurer.

Purpose.—This organization is not actively concerned with the actual construction and improvement of roads, but work, is mainly along educational lines.

Canadian Society of Civil Engineers

Officers.—P. Johnson, Montreal, president; H. H. Vaughan, Montreal, F. C. Gamble, Victoria, B. C., J. G. Sullivan, Winnipeg, vice-presidents; E. Marceau, Montreal, treasurer; C. H. McLeon, Montreal, secretary.

Committee on Roads.—A. W. Campbell, Deputy Minister of Railways and Canals, Ottawa, Ontario, chairman.

Capital Highway Association

Officers.—Leonard Tufts, president, Pinehurst, N. C.; John R. McQueen, secretary, Pinehurst, N. C.

Coast to Coast Highway Association

Officers.—H. Barnett, Nebraska, president; Lafayette Young, Iowa, vice-president; G. E. Parisoe, Minden, Nebr. (headquarters), secretary; E. B. Yetter, Colorado, treasurer.

Farmers' Educational and Coöperative Union of America

Officers.—Charles S. Barrett, president, Union City, Georgia; A. V. Swift, vice-president, Oregon.

Farmers' National Congress

Officers.—W. G. Ames, Oregon, Wisconsin, president; R. H. Kirby, Dallas City, Illinois, first vice-president; H. E. Stockbridge, Atlanta, Georgia, second vice-president; D. K. Unsicker, Wright, Iowa, third vice-president; O. D. Hill, Kendalia, W. Va., secretary; Levy Morrison, Greenville, Pa., treasurer; John M. Stahl, Chicago, Ill., legislative agent.

Federation of American Motorcyclists

Officers.—Dr. B. J. Patterson, Pratt, Kansas, president; G. B. Gibson, Lock Box 947, Westboro, Massachusetts, secretary-treasurer.

Good Roads Educational Association

Officers.—Frank Roden, 99 King Street, W. Toronto, Canada, president; Geo. S. Henry, Todmorden, Rural Route No. 1, Canada, treasurer; E. A. James, 57 Adelaide Street, E. Toronto, Canada, acting secretary.

International Association for Testing Materials

Officers.—Dr. Ing. N. Belelubsky, 14a Bronnitzkaja, St. Petersburg, Russia, president; M. G. C. Lloyd, 28 Victoria Street, London, England, M. A. Mesnager, 182 Rue de Rivoli, Paris, France, Dr. Ing. A. Martens, Direktor des kgl. Material prufungsamtes, Berlin-Lichterfelde, Germany, vice-presidents; Ernest Reitler, secretary-general, Norbahanstrasse 50, Vienna, Austria.

Committee on Testing Materials.—M. A. Mesnager, president.

Inter-Mountain Good Roads Association

Officers.—L. P. McCalla, Boise, Idaho, president; J. C. Moore, Butte, Montana, vice-president; T. H. Burton, Nephi, Utah, secretary-treasurer; the chairman of the Board of Commissioners of each county in the States of Utah, Idaho, Montana, Wyoming Nevada and Colorado, is a vice-president.

Lincoln Highway Association

Officers.—Henry B. Joy, Detroit, Michigan, president; Carl G. Fisher, Indianapolis, Indiana, vice-president; A. R. Pardington, vice-president and secretary, Detroit, Mich.; Emory W. Clark, treasurer, Detroit, Mich.

National Highways Protective Society

Officers.—Frederic R. Coudert, President; Bradley Martin, vice-president; Col. Edward S. Cornell, 1 West 34th Street, New York, secretary; Joseph A. Herron, treasurer.

National Conference on Concrete Road Building

Officers.—W. F. M. Goss, chairman; J. P. Beck, secretary, 208 South La Salle Street Chicago, Ill.

National Grange

Officers.—Oliver Wilson, master, Peoria, Illinois; N. P. Hull, lecturer, Dimondale, Michigan; C. M. Freeman, secretary, Tippecanoe City, Ohio. C. S. Stetson, chairman executive committee, Greene, Maine.

One of the Purposes.—The Grange is actively interested in the movement for better roads, particularly the movement for State and national legislation on the subject.

National Highways Association

Officers.—General Coleman du Pont, chairman board of councillors, Wilmington, Delaware; Charles Henry Davis, C. E., president, New York City, N. Y.; Frederick Remsen Hutton M. E., Sc.D., general secretary, New York City, N. Y.

Headquarters.—18 Old Slip, New York City, N. Y.

Purposes.—To bring about the building of a system of national highways.

National Old Trails Road Association

Officers.—J. M. Lowe, president, Kansas City, Missouri.

Headquarters.—222 Midland Building, Kansas City, Missouri.

National Congress of Mothers

Officers.—Mrs. Frederic Schoff, president, 3418 Baring Street, Philadelphia, Mrs. James S. Bolton, recording secretary, New Haven, Conn; Mrs. Arthur A. Birney, corresponding secretary, 806 Washington Loan and Trust Building, Washington D. C.;

Mrs. W. B. Ferguson, treasurer; Logan Waller Page, Country Life Department, U. S. Department of Agriculture, Washington, D. C.

Northwestern Road Congress

Officers.—George W. Cooley, president, St. Paul, Minn.

National Rural Letter Carriers' Association

Officers.—George B. Kime, president, Willard, Mo.; Fred L. White, vice-president, Buckhead, Ga.; L. H. Wilson, secretary, Olivia, Minn.; I. P. Cammarn, treasurer, Upper Sandusky, O.; A. Russell, Monticello, Miss., John L. Smith, Marshall, Mich., L. M. Onyett, Fort Branch, Ind., executive committee.

Ocean to Ocean Highway Association

Officers.—D. K. B. Sellers, Albuquerque, New Mexico, president; Fred T. Colter, Springerville, Arizona, first vice-president; J. Y. Aragon, Magdalena, New Mexico, second vice-president; C. O. Barker, Banning, California, third vice-president; John Becker, Jr., Belen, New Mexico, secretary; Frank McKee, Albuquerque, New Mexico, treasurer.

Omaha-Lincoln-Denver Trans-Continental Route

Officers.—S. A. Searle, Omaha, Nebraska, president; A. Barnett McCook, Nebraska, first vice-president; C. J. Bowlby, Friend, Nebraska, second vice-president; George E. Parisoe, Minden, Nebraska, secretary; W. A. Taylor, Hastings, Nebraska, treasurer.

Pacific Highway Association of North America

Officers.—J. T. Roland, Seattle, Washington, life president; Samuel Hill, Portland, Oregon, president; Frank M. Fretwell, Seattle, Washington, secretary; H. L. Bowlby, Salem, Oregon, executive officer.

Pacific Coast Good Roads Association

Officer.—George E. Boos, Medford, Oregon, secretary.

Quebec-Miami International Highway Association

Officers.—Howard D. Hadley, president, Plattsburgh, New York, George A. Simard, vico-president, care Franco-American Chemical Company, Montreal, P. Q.; N. M. Parrott, secretary, 733 Calvert Building, Baltimore, Md.

Southern Commercial Congress

Officers.—Duncan U. Fletcher, president; Clarence J. Owens, managing director; William H. Saunders, resident director, Chas. D. Douglas, general counsel.

Headquarters.—Southern Building, Washington, D. C.

Purposes.—Relating to road improvement. To encourage the movement for the construction of good roads and for the extension of railroad and trolley transportation.

Southern National Highway

Officers.—Colonel Dell M. Potter of Clifton, Arizona, president; Colonel Bennehan Cameron of Stagville, North Carolina, general vice-president; Mr. D. R. Ellis of Clifton, Arizona, secretary; and Mr. E. W. Jackson of San Diego, California, treasurer.

Headquarters.—Clifton, Arizona.

Society for the Promotion of Engineering Education

Officers.—G. C. Anthony, Tufts College, Massachusetts, president; H. S. Jacoby, Ithaca, New York, and D. C. Humphreys, Lexington, Virginia, vice-presidents; Henry H. Norris, Cornell University, Ithaca, New York, secretary; William O. Wiley, New York, treasurer.

San Diego-Arizona Auxilliary of the Southern Ocean to Ocean Highway Association

Officers.—Ed. Fletcher, president, San Diego, Calif.

Santa Fe, Grand Canyon and Needles National Highway Association

Officers.—Dr. Johnson R. Whiteside, Kingman, Arizona, President; E. F. Thompson, Kingman, Arizona, secretary; R. P. Wheellock, Kingman, Arizona, assistant-secretary; M. L. Powers, Flagstaff, Arizona, treasurer.

Southern Appalachian Good Roads Association

Officers.—Joseph Hyde Pratt, Chapel Hill, N. C., president and treasurer; C. B. Scott, Richmond, Va., secretary.

The Travelers Protective Association of America

Officers.—George S. Armstrong, Merchantville, N. J., president; T. S. Logan, St. Louis, Mo., secretary and treasurer.

Good Roads and Public Utilities Committee.—E. B. Smith, Shreveport, Louisiana, chairman.

Texas, Arkansas & Louisiana Highway Association

Officers.—J. H. McHaney, president, Longview, Texas.

Twin City-Aberdeen-Yellowstone Park Trail

Officers.—J. E. Prindle, Ismay, Montana, president; J. W Parmley, Ipswich, South Dakota, first vice-president; G. A. Will, Minneapolis, Minnesota, second vice-president; F. A. Finch, Lemmon, South Dakota, secretary-treasurer.

The New Santa Fe Trail Association

Officers.—R. H. Faxon, Wichita, Kansas, president; C. H. Scott, Hutchinson, Kansas, secretary-treasurer; H. H. Taylor, Hutchinson, Kansas, official pilot.

State and Local Organizations

Alabama

Alabama Good Roads Association, John Craft, president, Mobile.

Alabama Association of Highway Engineers, R. P. Boyd, president, Montgomery, Alabama.

Alabama Convict Improvement Association, J. A. Rountree, chairman, Birmingham.

Birmingham-Montgomery Highway Association, W. S. Keller, president, Montgomery; Barney M. Roberst, secretary, Clanton.

Montgomery-Lowndes-Dallas Highway Association, W. D. McCurdy, president, Lowndesboro; J. T. Jackson, secretary, Benton.

Decatur-Birmingham Highway Association, M. L. Robertson, president, Cullman, Ala.; J. D. Senig, secretary, Cullman, Ala.

Talladega-Montgomery Highway Association, Judge J. E. Camp, chairman, Talladega, Ala.

Florence-Tuscaloosa Highway Association, Judge E. B. Alman, president, Tuscumbia, Ala.

Calhoun County Good Roads Association, W. T. Goodlet, secretary, Jacksonville.

Clarke County Good Roads Association, A. B. Tucker, president, Thomasville.

Colbert County Good Roads Association, J. E. Isbell, president, Tuscumbia.

Dallas County Good Roads Association, Clifton Kirkpatrick, president, Cahaba.

Elmore County Good Roads Association, H. H. Golson, secretary, Wetumpka.

Etowah County Good Roads Association, W. P. Archer, president, Gadsden, J. L. Irving, secretary, Gadsden.

Franklin County Good Roads Association, J. Gassier, president, R. F. D. Russellville; J. C. Norwood, secretary, Russellville.

Henry County Good Roads Association, Hon. J. R. Ward, president, Abbeville.

Houston County Good Roads Association, W. R. Flowers, president, Dothan.

Jefferson County Good Roads Association, John W. O'Neill, president, Birmingham; J. A. Rountree, secretary–treasurer, Birmingham.

Lauderdale County Good Roads Association, Florence.

Madison County Rural Letter Carriers' Association, Arthur P. Dean, president, Huntsville.

Talladega County Good Roads Association, A. L. McElderry, president, Talladega.

Arizona

Arizona Good Roads Association, T. G. Norris, president, Prescott; M. A. Fraser, secretary, Prescott.

Northern Arizona Good Roads Association, E. F. Thompson, secretary, Kingman.

Borderland Route Association, J. F. Myers, president, Tucson; J. F. Gray, secretary.

Warren District Club, Good Roads Committee, John J. Bowen, chairman, Bisbee.

Mohave County Good Roads Association, Carl G. Krook, president, Kingman; E. F. Thompson, secretary-treasurer.

Arkansas

Arkansas Good Roads and Drainage Association, C. M. Philpot, president, Pine Bluff.

Little Rock-Texarkana Highway Association, W. Y. Foster, president, Hope.

Crawford County Roads Association, Dr. J. E. Blakemore, president, Van Buren.

Northeast Arkansas and Southeast Missouri Good Roads Association, W. E. Spence, president, Piggott, Ark.; C. W. Highfill, secretary, Paragould, Ark.

Ozark Trails Association, W. H. Harvey, president, Monte Ne, Ark.

Sharp County Good Roads Association, Thomas J. Wood, president, Evening Shade.

St. Francis County Branch of Memphis-Little Rock Highway Association, James Scott, president, Forrest City.

Washington County Good Roads Association, C. E. Pritchard, president, Fayetteville.

Woodruff County Good Roads Association, T. L. Gardner, Augusta.

California

Amador County Good Roads Association, C. E. Jarvis, secretary, Jackson, Calif.

Inyo County Good Roads Club, W. L. Scott, Terminal Hotel, San Francisco, Calif.; Dr. G. B. Doyle, president, Bishop, Calif.

Napa County Good Roads Association, F. A. Golds, president, Napa, Calif.; E. W. Bendley, secretary, Napa, Calif.

Sonoma County Good Roads Club, D. D. Wagers, secretary, Santa Rosa, Calif.

Tulare County Highway Association, W. P. Boone, secretary, Visalia, Calif.

Colorado

Arkansas, Rio Grande, Gunnison & Grande River Highway Association, C. R. McLain, president, Canon City.

Central Colorado Highway Association, L. E. Curtis, president, Colorado Springs.

Colorado Good Roads Convention, L. E. Curtis, president, Colorado Springs; W. H. Emmons, secretary, Chamber of Commerce Building, Denver.

Colorado Road Builders Association, R. H. Higgins, president, Pueblo; E. E. Sommers, vice-president, Denver; T. W. Monell, secretary-treasurer, Montrose.

Arapahoe County Good Roads Association, Littleton.
El Paso County Good Roads Association, Colorado Springs.
Fremont County Good Roads Association, Canon City.
Jefferson County Good Roads Association, Golden.
La Plata County Good Roads Association, Chamber of Commerce, Durango
Las Animas County Good Roads Association. Trinidad.
Lincoln Highway Association of Colorado, Leonard E. Curtis, president, Colorado Springs, Colo.; R. E. Lee Giles, secretary-treasurer, Manitou, Colo.
Park County Good Roads Association, Fairplay.
Pitkin County Good Roads Association, Aspen.
Prowers County Good Roads Association, Holly.
Rio Blanco County Good Roads Association, Meeker.
San Juan County Good Roads Association, Chamber of Commerce, Silverton.
Weld County Good Roads Association, Ault & Greeley.

Connecticut

Association of Connecticut Road Builders, Hartford, Alfred H. Terry, president, Bridgeport; Robert E. Mitchell, vice-president, Willimantic; R. J. Rose, secretary-treasurer, Hartford.
Connecticut Good Roads Association, 902 Chapel St., Room 701, New Haven, Henry A. Bishop, president, Bridgeport; Don C. Seitz, 1st vice-president, Greenwich; Wallace F. Fenn, 2d vice-president, Hartford; George W. Eames, 3d vice-president, Bridgeport; Philip Bond, treasurer, New Haven; Charles Marcy Robinson, secretary, New Haven.
Connecticut Road Officials Association, Alfred H. Terry, president, Bridgeport; R. J. Ross, Secretary-treasurer, Hartford; W. E. Kennedy, vice-president, Waterbury.
Fairfield County: Redding Protective League, Dan Beard, chairman, Redding; Charles H. Plump, secretary, Redding; J. B. Sanford, treasurer, Redding.
New Haven County: Waterbury Good Roads Association, George Tracy, president, Waterbury; W. B. Reynolds, secretary, Waterbury; F. C. Peabody, treasurer, Waterbury.

Delaware

Delaware Good Roads Association, Laurel, Delaware.

Georgia

Atlantic & Gulf Highway Association, Dr. G. P. Folks, president, Waycross; C. Fort Andrews, secretary, Waycross.
Battlefield Route Association, George A. Veach, president, Adams Park; W. H. Field, secretary, Cartersville.
Central Route Association, Capt. H. H. Tift, president, Tifton.
Georgia-Alabama Good Roads Association, F. C. Lumpkin, president, Columbus.
Georgia Federation of Road Authorities, Wm. F. Eve, president, Augusta.
Georgia Good Roads Club, Fred. L. White, president, Buckhead.
North Georgia Good Roads Association, A. N. Tumlin, president, Cave Springs.
South Georgia Good Roads Association, L. V. Williams, president, Waycross; C. F. Andrews, secretary, Waycross.
Georgia Carolina Good Roads Association. E. J. Watson, president, Columbia, S. C.

Columbus. Harris County & Pine Mountain Good Roads Association, R. L. Baldwin President, Waverly Hall, Georgia.
Georgia Association of County Road Commissioners, W. T. Winn, president, Atlanta, Ga.; Fred Houser, secretary, Atlanta, Ga.
North Georgia Good Roads Association, A. N. Tumlin, president, Cave Springs, Ga.
Chattahoochie County Good Roads Association, F. G. Lumpkin, president; L. J. Henderson, secretary, Columbus, Ga.
Appling County Good Roads Association, W. H. Tilman, president, Surrency.
Ben Hill County Good Roads Club, J. G. Knapp, president, Fitzgerald.
Berrien County Good Roads Association, Danl. McCraney, president, Sparks.
Brooks County Highway Improvement Association, H. W. Stubbs, president, Quitman.
Butts County Good Roads Association, S. J. Smith, president, Jackson.
Charlton County Good Roads Association, P. T. Osterman, president, St. George.
Clarke County Good Roads Association, Martin J. Abney, president, Athens.
Clinch County Good Roads Association, J. T. Dame, president, Homerville.
Crawford County Good Roads Association, S. H. Phelan, president, Roberta.
Crisp County Good Roads Association, Dr. T. J. McArthur, president, Cordele.
Dodge County Good Roads Association, Sol Herrman, president, Eastman.
Dooly County Good Roads Association, J. O. Heard, president, Vienna.
Douglas County Good Roads Association, A. S. Gresham, president, Douglasville.
Elbert County Good Roads Association, L. M. Brown, president, R. F. D. 3, Elberton.
Fayette County Good Roads Association, A. O. Bloblock, president, Fayetteville.
Glascock County Good Roads Association, Albert Logue, president, Gibson.
Glynn County Good Roads Association, Albert Fendig, president, Brunswick.
Grady County Good Roads Association, W. B. Roddenberg, president, Cairo.
Greene County Good Roads Club, W. P. McWhorter, president, Woodville.
Habersham County Good Roads Association, John Martin, president, Clarkesville; W. S. Irwin, secretary, Clarkesville.
Hall County Good Roads Association, J. M. Mundy, president, Gainesville.
Hart County Good Roads Association, L. S. Brown, president, Hartwell.
Houston County Good Roads Association, J. L. Fincher, president, Ft. Valley.
Jeff Davis County Good Roads Association, N. L. Hatten, Hazelhurst.
Jefferson County Good Roads Association, W. J. Wrens, president, Wrens.
Jackson County Good Roads Association, W. C. Davis, president, Commerce.
Liberty County Good Roads Association, Dr. D. W. Baggs, president, Ludowici.
Meriweather County Good Roads Association, J. M. Barnes, president, Bullochville.
Monroe County Good Roads Association, Col. J. O. Persons, president, Forsyth.
Newton County Good Roads Club, L. W. Jarman. president, Porterdale, J. H. Echols, secretary, Covington.

Ninth Ward and West DeKalb Good Roads Improvement Club, A. S. Hock, president, Kirkwood.

Pierce County Good Roads Association, L. W. Root, president, Blacksbear,

Piedmont Highway Association, Wm. Eberhart, president, Cornelia.

Pike County Good Roads Association, W. A. Strickland, president, Concord.

Pulaski County Good Roads Association, T. D. Walker, president, Cochran.

Rabun County Good Roads Association, A. J. Duncan, president, Clayton.

Richmond County Good Roads Association, D. C. Haynes, president, Augusta.

Spalding County Good Roads Association, Hon. Roswell H. Drake, president, Griffin.

Taylor County Good Roads Association, W. D. Steed, president, Butler.

Telfair County Good Roads Association, Capt. T. J. Smith, president, McRae.

Tift County Good Roads Association, Capt. H. H. Tift, president, Tifton; W. E. Farmer, secretary, Tifton.

Turner County Good Roads Association J. S. Shingler, president, Ashburn,

Upson County Good Roads Association, O. B. Clements, president, Yatesville.

Ware County Good Roads Association, Dr. G. P. Folks, president, Waycross.

Washington County Good Roads Association, C. H. Shephard, president, Tennille.

Wayne County Good Roads Association, W. J. Broadhurst, president, Jesup.

Illinois

Illinois Bankers Association, S. E. Bradt, chairman, DeKalb.

Illinois Commercial Federation, C. A. Kiler, chairman, Champaign.

Illinois Official Trans-Continental Route Association, Geo. E. Stocking, president, Rochelle; S. F. Durga, secretary, DeKalb.

Illinois Highway Improvement Association, Wm. G. Edens, president, Central Trust Co., Chicago; R. J. Finnegan, secretary, 15 South Market St., Chicago.

Bureau County Road Improvement Association, C. O. Brigham, president, Princeton; K. B. Seibel, secretary, Princeton.

Clark County: Casey Good Roads Club, W. M. Abraham, secretary, Casey.

Cumberland County National Road Association, P. J. Bowman, president, Greenup; E. M. Eckard, secretary, Greenup.

DeKalb County: Waterman Coöperative Good Roads League, Dr. C. H. Wilkenson, president, Waterman; W. T. Wiltberger, secretary, Waterman.

Effingham County Good Roads Association, A. D. McCallen, president, Effingham.

Effingham Good Roads Club, J. H. Curry, secretary, Effingham.

Henry County: Galva Good Roads Improvement Association, John Miller, chairman, Galva.

Jo Daviess County: Progressive Good Roads Club, Dr. D. G. Smith, president, Elizabeth; C. A. Walters, secretary, Elizabeth.

Macoupin County: Betsey Ann Association Inc., H. A. Heidemann, president, Brighton; Irvin M. Clark, secretary, Brighton.

Randolph County Good Roads Association, L. H. Paulter, Evansville.

Rock Island County: Black Hawk Good Roads Association, D. W. Matthews, president, Milan.

Rock Island County: Highway Improvement Association, E. W. Woodcock, secretary, Moline.

St Clair County: Good Roads Coöperative League, G. G. Bock, president, Smithton.

Washington County Good Roads Association, W. O. Weihe, president, Nashville.

Indiana

Good Roads Association, T. L. Wheeler, secretary, Huntington.

Indiana Association of County Commissioners & County Attorneys, Indianapolis.

Indiana Federated Commercial Clubs, Good Roads Committee, L. H. Lewis, secretary, Indianapolis.

Indiana Good Roads Association, C. A. Kenyon, president, Meridian Life Building, Indianapolis.

Indiana Letter Carriers' Association, Good Roads Committee, W. J. Ward, chairman, Carmel.

Northern Indiana Good Roads Association, Aaron Jones, president, South Bend; C. E. Craybill, secretary, South Bend.

Clark County: Fayette Township Good Roads Association, John Loesch, secretary, Floyd Knobs.

Hendricks County: Plainfield Improvement League, Dr. Amos Carter, president, Plainfield.

Jefferson County Good Roads Association, John McGregor, president, Madison.

Carroll County: Delphi Branch Indiana Good Roads Association, James B. Engles, secretary, Delphi, Ind.

Dekalb County: Auburn Branch Indiana Good Roads Association, W. H. Willenar, president, Auburn, Ind.; W. H. Schaab, secretary, Auburn, Ind.

Delaware County: Muncie Branch Indiana Good Roads Association, Harry L. Kitselman, president, Muncie, Ind.

Hamilton County: Noblesville Branch Indiana Good Roads Association, Newton W. Cowgill, secretary, Noblesville, Ind.

Johnson County: Franklin Branch Indiana Good Roads Association, Robert A. Brown, president, Franklin, Ind.; Robert W. Wilson, secretary, Franklin, Ind.

Greenwood Branch Indiana Good Roads Association, H. A. Craig, president, Greenwood, Ind.; S. E. Wright, secretary, Greenwood, Ind.

Lake County: Hammond Branch Indiana Good Roads Association, A. M. Turner, president, Hammond, Ind.

Morgan County: Martinsville Branch Indiana Good Roads Association, Odin R. Smith, president, Martinsville, Ind.; O. C. Toner, secretary, Martinsville, Ind.

Mooresville Branch Indiana Good Roads Association, D. B. Johnson, president, Mooresville, Ind.; Geo. I. Reeves, secretary, Mooresville, Ind.

Steuben County: Angola Branch Indiana Good Roads Association, F. A. Emerson, president, Angola, Ind.; Cary E. Covell, secretary, Angola, Ind.

Idaho

Ada County Good Roads Association, K. P. McCalla, president, Boise, Idaho.

Blaine County Good Roads Association, Earl Fox, president, Hailey, Idaho.

Canyon County: Nampa Highway District, O. G. Reinhardt, president. Nampa, Idaho.

Fremont County: Upper Snake River Good Roads Association, Mark Austin, president, Rexburg, Idaho.

Idaho County Good Roads Association, Grangeville, Idaho.

Iowa

Ayr Line Association, Albert I. Smith, president, Mount Ayr; H. C. Beard, secretary, Mount Ayr,
Blue Grass Road, Joe L. Long. president, Des Moines.
Cannon Ball Trail, Robert Carson, Iowa City.
Corn Belt Highway, F. L. Hall, Secretary, Weldon.
Council Bluffs, Sioux City & Spirit Lake Highway Association, Frank Patch, president, Hartley.
Des Moines-Fort Dodge & Spirit Lake Highway Association, J. F. Ford, secretary, Fort Dodge.
Des Moines Thresher Club, W. L. Trueblood, president, Des Moines.
"Great White Way", Toy A. Stacy, secretary, Adair.
Hawkeye Highway, Dr. H. M. Bradley, secretary, Manchester.
Inter-State Trail Association, W. A. Hopkins, Lamoni.
I-O-A Short Line, Chas. F. Walling, president, Oskaloosa.
Iowa Good Roads Association, Lafayette Young, Sr., president, Des Moines; Thos. H. MacDonald, secretary, Ames.
Iowa Official Transcontinental Route (Lincoln Memorial Highway), W. F. Haskell, president, Cedar Rapids; W. C. Rollins, secretary, Denison.
Iowa State Quarrymen's Association, James W. Burroughs, secretary, Marshalltown.
North Iowa Pike Association, Wm. Hathorn, secretary, Mason City.
River-to-River Road Association, Bert N. Mills, secretary, Des Moines.
Waubonsie Trail, U. G. Reininger, president, Sioux Falls, S. D.
Adams County: Prescott Community Improvement Club, H. M. Stanley, secretary, Prescott.
Black Hawk County Good Roads Club, F. A. Ferguson, president, Waterloo.
Buena Vista County: Storm Lake-Okobogi Air Line, Scott Bradford, president, Storm Lake.
Lee County: Fort Madison First Association, S. Atlee, president, Ft. Madison; J. R. Frailey, secretary, Ft. Madison.
Lucas County: Russell Boulevard Association, Algmer J. Allen, president, Russell.
Guthrie County: Panora Speedway Association, W. G. Roberts, Panora, Iowa.
Montgomery County Highway Commission, H. M. Howard, Red Oak, Iowa.

Kansas

Kansas State Good Roads Association, O. M. Wilhite, president, Emporia; G. J. Hinshaw, secretary, Newton.
Kansas Engineering Society, J. M. Meade, president, Topeka; T. J. Strickler, secretary-treasurer, Topeka.
Meridian Road Association, John C. Nicholson, president, Newton.
Kansas Division, W. W. Watson, president, Salina; S. E. Jackman, secretary, Minneapolis.
Old Santa Fe Trail, T. W. Whiting, president, Council Grove; Frank A. Davis, secretary, Herington.
Golden Belt Road Association, C. M. Harger, president, Abilene; George Caldwell, secretary, Salina.
Sunflower Trail, R. M. Anderson, president, Beloit; L. A. Mergen, secretary, Beloit.
Oil Belt Route, H. W. Loy, president, Chanute; Herbert Cavaness, secretary Chanute.
Tri-State Trail, H. O. Douglass, president, Oberlin; Chas. Sawyer, secretary-treasurer, Norton.

The New Santa Fe Trail, R. H. Faxon, president, Garden City; C. H. Scott, secretary-treasurer, Hutchinson.

Rock Island Highway, C. W. Cole, president, Newton; A. Q. Miller, secretary-treasurer, Belleville.

Atchison County Good Roads Association, A. S. Drury, president, Atchison; Alva Clapp, secretary, Atchison.

Cloud County Good Roads Association, P. G. Harmon, secretary-treasurer, Concordia.

Geary County Good Roads Association, Dr. W. S. Yates, president, Junction City; O. E. Hutchings, secretary-treasurer, Junction City.

Graham County Good Roads Association, William Burns, president, Bogue; D. C. Green, secretary, Hill City.

Montgomery County Good Roads Association, H. G. James, president, Independence; Sam L. McMurtry, secretary, Independence.

Cherryvale Good Roads Association, H. M. Casebeer, president, Cherryvale; F. D. Moffett, secretary-treasurer, Cherryvale.

Nemaha County: Goff Improvement Association, Chas. A. Richard, president, Goff; E. E. Holstone, secretary, Goff.

Shawnee County Good Roads Association, A. E. McGregor, president, Washington.

Linn Good Roads Association, Henry Meierkord, secretary-treasurer, Linn.

Red Line Road Association, L. F. Davidson, president, Glasco, Kans.; W. F. Hughes, secretary, Plainville, Kans.

Canada, Kansas City and Gulf Road Association, F. O. Peiper, president, Paola, Kans.; Oscar Rice, secretary, Fort Scott, Kans.

National Old Trails Road Association, T. W. Whiting, president, Council Grove, Kans.; W. H. Mott, secretary, Herington, Kans.

Solomon Valley Highway Association, J. Q. Adams, president, Stockton, Kans.; I. R. Mort, secretary-treasurer, Hill City, Kans.

The Kansas White Way, B. F. Morgan, president, Clay Center, Kans.; J. Q. Adams, secretary, Stockton, Kans.

Neosho Valley Good Roads Association, M. A. Limbocker, president, Burlington, Kans.; S. D. Weaver, secretary-treasurer, Burlington, Kans.

Corn Belt Road Association, M. S. McCreight, president, Oskaloosa, Kans.; Dr. Watkins, secretary, Tonganoxie, Kans.

Eastern Kansas Good Roads Association, J. Frank Smith, Pleasanton, Kans.; W. P. Conkey, secretary, Pleasanton, Kans.

Kentucky

Kentucky Good Roads Association, R. J. McBride, president, Louisville Times, Louisville; R. C. Terrell, secretary, Frankfort.

Kentucky County Road Engineers Association. Guthrie Wilson, president, Bardstown, Ky.; R. C. Terrell, chairman executive committee, Frankfort, Ky.; J. G. Baxter, secretary, Richmond, Ky.; J. F. Grimes, secretary executive committee, Frankfort, Ky.

Breathitt County Good Roads Club, South Strong, president, Jackson, Ky.; Alfred Russell, secretary, Jackson, Ky.

Knott County Good Roads Club, Judge R. M. Amburgy, president, Hindman, Ky.; John M. Baker, secretary, Hindman, Ky.

Leslie County: Wooten Good Roads Club, W. M. Dixon, president, Wooten, Ky.; Chester Dixon, secretary, Wooten, Ky.

Leslie County Good Roads Club, Judge T. G. Lewis, president, Hyden, Ky.; R. L. Dixon, secretary, Hyden, Ky.

Letcher County Good Roads Club, Judge H. T. Day, president, Whitesburg, Ky., L. E. Hawie, secretary, Whitesburg, Ky.

Perry County Good Roads Club, Judge J. G. Campbell, president, Hazard, Ky.; Rebel Martin, secretary, Hazard, Ky.

Southern Kentucky Good Roads Association, N. R. Patterson, president, Pineville; Miss Lena Rollins, secretary, Pineville, George H. Reese, treasurer, Pineville.

Breckenridge County Good Roads Association, W. J. Piggott, president, Irvington, Mrs. R. B. McGlothlan, secretary, Irvington.

Crittenden County: Good Roads Committee, Carl Henderson, president, Marion; G. T. Belt, secretary, Sheridan.

Henry County Citizens League, Park C. Smith, president, Smithfield; E. A. Gullion, secretary, New Castle.

Hopkins County Road Association, J. F. Gordon, president, Madisonville; G. W. Sypert, secretary, Madisonville.

Kenton County Good Roads Association, W. L. White, secretary, R.F.D. 1, Latonia.

Knox County: Boone Way Booster Band, J. T. Stamper, president, Barbourville; W. H. McDonald, secretary.

Larue County: Central Lincoln Road Club, Dr. J. C. Jones, president, Buffalo; W. G. Dezarn, secretary-treasurer, Hodgenville.

McCracken County: Joint Committee of Board of Trade, Retail Merchants Association, and Automobile Club, B. Weille, chairman, Paducah.

Paducah Road Association, C. W. Craig, president, Paducah; Ben Wrillie, secretary, Paducah.

Glade District Good Roads Association, John L. Gay, president, Berea.

Nelson County: Good Roads Association (Bloomfield,) Guthrie Wilson, secretary, Bardstown.

Rockcastle County: Boone Way Booster Band, W. H. Fish, president, Mt. Vernon; James Maret, secretary-treasurer, Mt. Vernon.

Rowan County Good Roads Association, S. M. Bradley, president, Morehead; B. S. Wilson, secretary, Morehead; H. H. Caudill, treasurer, Morehead.

Todd County Good Roads Association, George Snadon, chairman, Guthrie; George Weathers, secretary, Elkton.

Warren County Good Roads Association, Dr. Jos. N. McCormack, president, Bowling Green.

Whitley County Good Roads Organization, S. Stanfill, chairman, Williamsburg; H. C. Gillis, secretary.

Louisiana

Louisiana Good Roads Association, P. M. Milner, president, Hibernia Bank Bldg., New Orleans, La.; W. E. Atkinson, ex-officio vice president, State highway engineer, New Orleans, La.; nine vice-presidents, one from each congressional district.

Allen Parish Good Roads Association, Dr. M. V. Hargrove, president, Oakdale, La.

St. Tammany Parish: Good Roads Committee, E. J. Domerque, Jr., chairman, Covington, La.; R. L. Aubert, secretary, Covington, La.

Baton Rouge-New Orleans Good Roads Association, F. B. McQuesty, secretary, Baton Rouge.

Acadia Parish Good Roads Association, H. E. Lewis, president, Crowley.

Calcasieu Parish Good Roads Association, Dr. J. M. Ways, president, Kinder.

Iberia Parish Good Roads Association, Dr. Guy Shaw, president, Loreauville.

Ouachita Parish: East Side Road Committee, Victor C. Barringer, secretary, Monroe.

St. Landry Parish Good Roads Association, Jas. O. Chachere, president, Opelousas.

Maine

Aroostook County Good Roads Association, Howard W. Safford, president, Mars Hill; Michael M. Clarke, secretary, Houlton.

Knox County Automobile & Good Roads Association, A. S. Littlefield, president, Rockland.

Piscataquis County Good Roads Association, E. E. Whitney, president, Dover; C. E. Kimball, secretary-treasurer, Dover.

Kennebunk Good Roads Association, Dr. Frank M. Ross, president, Kennebunk; Frank W. Bonser, secretary.

Maryland

Baltimore County Good Roads Association, J. Frank Shipley, president, Gwynbrook; D. Frank Shamberger, secretary, 1507 McCulloh St., Baltimore.

Baltimore Engineers' Club, J. H. Milburn, c/o B. & O. R. R. Co., president; Baltimore, H. C. Williar, secretary, c/o Paving Commission, Baltimore.

Arlington Improvement Association, Chas. T. Cockey, Jr., president, Arlington.

Belair Road Improvement & Protective Association, Dr. A. L. Wilkinson, president, Raspeburg.

Central Park Improvement Association, R. H. Williams, president, 619 Gaither building, Baltimore.

Catonsville Neighborhood Improvement Association, John Hubner, president, Catonsville.

East Arlington Improvement Association, Chas. Goldeisen, president, Arlington.

Govans Improvement Association, Dr. E. M. Duncan, president, Govans.

Good Roads Association, Major John I. Yellott, president, Towson.

Green Spring Park & Pimlico Road Improvement Association, Wm. G. Henkel, president, 1021 Light Street, Baltimore.

Halethorpe Protective & Improvement Association, Dr. Fred V. Beitler, president, Halethorpe.

Hamilton Improvement Association, William McCallister, president, Hamilton.

Hayward Improvement Association, W. O. Smith, president, Arlington.

Hebbville Improvement Association, Wm. F. Piel, Jr., president, Hebbville.

Hereford Improvement Association, Dr. Fred G. Mitchell, president, Glencoe.

Hillsdale Improvement Association, E. S. Hutton, president, Hillsdale.

Howard Park Improvement Association, Louis Moller, president, 111 Light St., Baltimore.

Lansdowne Improvement Association, J. D. W. Lindquist, president, Lansdowne.

Lauraville Improvement Association, Frederick Evans, president, Lauraville.

Lutherville Improvement Association, J. Robert Wood, president, Lutherville.

Marble Hill Improvement Association, George Jessup, president, Cockeysville.

Mt. Washington Improvement Association, Frank J. LaMotte, president, Mt. Washington.

Orangeville Improvement Association, M. P. Ebaugh, president, Orangeville.

Park Heights Pimlico and Arlington Improvement Association, John Trainor, president, 877 N. Howard St., Baltimore.

Parkville Improvement Association, Thomas F. Mallonee, president, Parkville.

Pikesville Improvement Association, W. E. Lovering, president, Pikesville.
Relay Improvement Association, J. A. Baldwin, president, Relay.
Roland Park Civic League, Dr. Paul Haupt, president, Roland Park.
Towson Improvement Association, John I. Yellott, president, Towson.
Upper Falls Improvement Association, Edward Reynolds, president, Upper Falls.
Windsor Hills Improvement Association, Rev. W. A. Crawford Frost, president, Windsor Hills.
Chase Improvement Association, H. E. Brazier, president, Chase.
Neighborhood Association of Highlandtown and Canton, Townley R. Wolfe, president, 3518 Bank St., Baltimore.
Rockdale Improvement Association, H. E. Hough, president, Raspeburg.
St. Helena Improvement Association, Harry Marchant, president, St. Helena.
Woodlawn Improvement Association, G. L. Ellis, president, 316 W. Mulberry St., Baltimore.
Cecil County: Committee on Repair and Maintenance of Roads, S. G. England, R. H. Logan, Joseph T. Graves, all of North East, Md.
Harford County Road League, J. W. Davis, secretary, Rocks, Md.
Cecil County Farmers' Civic and Business Association, W. R. Cameron, president, Rising Sun; Mr. Briggs, secretary, North East.
East New Market Improvement Association, Chas. Webster, president, East New Market; W. A. Percy, secretary, Vienna.

Massachusetts

Massachusetts Highway Association, Wm. D. Sohier, president, Boston; John M. McCarthy, secretary, 15 Ashburton Place, Boston.
Essex County Associated Boards of Trade, Committee on Highways, John F. Browning, chairman, 418 Lafayette St., Salem.
Hampden County Improvement League, Horace A. Moses, president, Russell; John A. Scheuerle, general secretary, Massasoit Building, Springfield.

Michigan

Michigan Good Roads Association, P. T. Colgrove, president, Hastings; A. A. Anderson, secretary, Hastings.
Northeastern Michigan Development Bureau, Vet S. Maloney, president, Cheboygan; T. F. Marston, secretary-manager, Bay City.
Western Michigan Development Bureau, D. H. Day, president, Glen Haven; John I. Gibson, secretary, Traverse City.
Lake Huron Shore Good Roads Association, J. R. Snody, president, Onaway; John Simmons, secretary, Alpena; road commissioner, H. K. Gustin, Alpena.
West Michigan Pike Association, Dr. Wm. DeKleine, president, Grand Haven; Richard M. Hoffman, secretary-treasurer, Manistee.
Western Michigan Lakeshore Highway Asociation, Lee H. Trott, president, Muskegon; William De Kleine, secretary, Grand Haven.
Trunk Highway Association, W. F. Johnson, secretary, Roscommon.
Berrien County Good Roads Association, J. M. Ball, president, St. Joseph; I. W. Allen, secretary, St. Joseph.
Montcalm County: Stanton Good Roads Association, M. W. Stevenson, president, Stanton; D. A. Towle, secretary, Stanton.
Sheridan Good Roads Association, C. H. Clement, president, Sheridan; A. E. Stebbins, secretary, Stebbins.
Wexford County Good Roads Association, D. B. Kelley, president, Cadillac; Henry Knowlton, secretary, Cadillac.

Minnesota

Minnesota Road Makers' Association, John H. Mullen, secretary, St. Paul.

State Highway Association, Geo. W. Cooley, secretary, St. Paul.

Aitkin County: Aitkin Development Association, Mr. Warner, president, Aitkin.

Brown County: Springfield Good Roads and Development Association, Springfield.

Carlton County Development Association, Carlton.

Crow Wing County: Northern Development Association, C. A. Albright, president, Crow Wing.

Hennepin County: Minneapolis Civic and Commerce Association, Douglas A. Fiske, president, Minneapolis; Howard Strong, secretary, Minneapolis.

LeSuer County: Elysian Good Roads Association, C. Gologan, president, Elysian.

LeSuer Good Roads Association, Oscar Swenson, president, Le Suer.

New Prague Good Roads Association, J. F. Wraybeck, secretary, New Prague.

Nicollet County Good Roads Association, A. J. Potts, president, Nicollet.

Rice County: Lonsdale Good Roads Association, A. J. Smisek, president, Lonsdale.

Scott County Good Roads Association, J. H. Moore, president, Jordon; J. G. Casey, secretary, Jordan.

Steele County: Good Roads Association, Fred Jurgenson, secretary, Blooming Prairie.

Waseka County: Janesville Good Roads Association, Mr. Bardon, president Janesville.

New Richland Good Roads Association, M. A. Hodgkins, president, New Richland.

Waseka Good Roads Association, Dr. Blanchard, president, Waseka.

Mississippi

State Highway Association, C. C. Dunn, president, Corinth; M. L. Bipler, secretary, Biloxi.

Adams County Good Roads Committee, P. W. Mulverhill, secretary, Natches.

Alcorn County: Good Roads Association, R. L. Young, president, Corinth; W. D. Striplin, secretary, Corinth.

Chickasaw County Good Roads Committee, J. S. Rowe, chairman, Okolona; F. M. Elliott, secretary, Okolona.

Coahoma County: Good Roads Association, H. H. Hopson, chairman, Clarksdale; F. G. Wingfield, secretary, Clarksdale.

Forest County Good Roads Commission, J. K. Denham, chairman, Hattiesburg.

Harrison County Road Association, J. H. Long, president, Pass Christian; M. P. Bouslog, secretary, Gulfport.

Harrison County: Good Roads Committee, G. W. Grayson, president, Biloxi; S. M. Tracy, secretary, Biloxi.

Hinds County: Executive Committee, East and West Highway Association, Edgar S. Wilson, chairman, Jackson.

Lauderdale County Road Association, W. P. Moore, Engineer, Meridian.

Lincoln County Highway Commission, H. Cassidy, president, Brookhaven; Estus Smith, secretary, Brookhaven.

Marshall County Road Committee, W. B. Bradberry, president, Holly Springs; John E. Anderson, secretary, Holly Springs.

Montgomery County Road Commission, Henry Hart, chairman, Winona.
Newton County: Good Roads League, W. V. Fant, president, Newton,
Warren County Road Association, J. W. Tucker, president, Vicksburg; J. H. Adams, secretary, Vicksburg.
Yazoo County Road Association, E. L. Tarry, secretary, Yazoo City.

Missouri

Cannon Ball Trail Association, Jas. R. Bowsher, president, Leon; Chas. D. Davis, secretary, Princeton.
Capitol Route State Highway Association, J. H. Bothwell, president, Sedalia; M. V. Carroll, secretary, Sedalia.
Highway Engineers Association of Missouri, E. F. C. Harding, president, Jefferson City; Howard M. Shirkey, secretary, Richmond.
Missouri Association of County Judges, G. W. Pine, president, Palmyra; Curtis Hill, secretary, Columbia.
Missouri Highway Association, Roy F. Britton, president, St. Louis; J. B. Grigg, secretary, Joplin.
North Missouri Cross State Highway Association, George Robertson, president, Mexico; John F. Morton, secretary, Richmond.
Missouri Good Roads Association, E. E. E. McJimsey, president, Springfield; M. V. Carroll, secretary, Sedalia.
Old Trails Road Association, Walter Williams, president, Columbia; E. A. Mitchell, secretary, Marshall.
Sedalia-Springfield Highway Association, W. S. Jackson, president, Warsaw; M. V. Carroll, secretary, Sedalia.
Short Line Route Association, W. R. Littell, president, Tarkio; F. S. Travis, secretary, Tarkio.
St. Joe-Des Moines Interstate Trail Association, W. A. Hopkins, president, Lamoni; Dan'l Anderson, secretary, Lamoni, Ia.
St. Joe-Des Moines Ayr Line Association, A. I. Smith, president, Mt. Ayr; H. C. Beard, secretary, Mt. Ayr, Ia.
The Brotherhood of Good Road Draggers. G. W. Batterson, president, Sturgeon; Omar D. Gray, secretary, Sturgeon.
Barry County Good Roads Association, J. F. Normond, president, Monett; Bert Robbins, Secretary, Cassville.
Barton County Good Roads Association, W. J. Evilsizer, president, Lamar; James Graham, secretary-treasurer, Lamar.
Cass County: Westline Good Roads Association, G. W. Stark, secretary, Westline.
Daviess County Good Roads Association, George A. Iddings, president, R.F.D. 4, Pattonsburgh; Harvey B. Miller, secretary, Gallatin.
Franklin County Good Roads Association of St. Clair, C. E. Briegleb, president, St. Clair; Dr. W. E. Kitchell, secretary, St. Clair.
Howard County: Chariton Township Good Roads Association, Owen Harrison, president, Glasgow; E. W. Price, Secretary, Glasgow.
Jasper County 365 Day Road Club, J. D. Clarkson, president, Carthage; Chas. A. Blair, secretary, Carthage.
Perry County Good Roads Association, Robert H. Hudson, president, St. Marys; J. F. DeLassus, secretary, Crosstown.
St. Louis County Highway and Waterway Association, Gottlieb Bayer, president; Chesterfield, Fred Mueller, secretary, Clayton.
St. Louis County Olivette-Stratman Improvement Association, M. B. Greensfelder. president, Clayton; H. H. Elbring, secretary, Clayton.
Vernon County: Nevada Good Roads Club, R. A. Buckner, president, Nevada; J. M. Clack, secretary, Nevada.

Montana

Montana Good Roads Congress, Mr. Brown, president, Great Falls; P. N. Bernard, secretary, Kalispell.

Committee on State Road Project, Montana Society of Engineers, Clinton H. Moore, secretary, Butte.

Cascade County Good Roads Association, A. R. Wheeler, president, Great Falls; Walter S. Clark, secretary, Great Falls.

Lewis and Clarke County: Helena Good Roads Association, Lewis Penwell, president, Helena; A. C. Johnson, secretary, Helena.

Sweet Grass County Good Roads Association, Harvey Coit, president, Big Timber; Dorman Kellogg, secretary, Big Timber.

Nebraska

Meridian Road Association, Charles Baugh, York, secretary.

Boone County Good Roads Association, D. J. Poynter, secretary, Albion.

Brown County: Ainsworth Branch of Trans-Continental Route to Pacific Coast, John B. Stoll, secretary, Ainsworth.

Johnstown Div. of Trans-Continental Route to Pacific Coast, Ed. Bolhe, Johnstown.

Long Pine Div. of Trans-Continental Route to Pacific Coast, W. A. Bucklin, secretary, Long pine.

Cass County Good Roads Association, C. E. Tefft, secretary, Weeping Water.

Cherry County: Wood Lake Good Roads Association, W. F. Parker, secretary, Wood Lake.

Colfax County Good Roads Association, J. E. McNabb, secretary, Schuyler.

Dawes County: Chadron Good Roads Association, W. S. Gillam, secretary, Chadron.

Dodge County Good Roads Association, George F. Staats, secretary, Fremont.

Douglas County Good Roads Association, W. J. Kirkland, secretary,Omaha.

Hall County: Grand Island Good Roads Club, A. M. Connors, secretary, Grand Island.

Howard County Good Roads Association, A. L. Baliman, secretary, St. Paul.

Lancaster County Good Roads Association, Fred C. Fiske, secretary, Lincoln.

Madison County Good Roads Association, C. B. Dalter, secretary, Madison.

Nance County Good Roads Association, J. D. Barnes, secretary, Fullerton.

Scotts Bluff County Auto and Good Roads Association, C. A. Morrill, secretary, Scotts Bluff.

Washington County: Arlington Auto and Good Roads Association, R. A. Davies, secretary, Arlington.

New Jersey

New Jersey Association of County Engineers, Joshua Doughty, Jr., president, Somerville; E. E. Reed, secretary, Trenton.

New Mexico

Bernalillo County: Ocean to Ocean Highway Association, D. K. B. Sellers, president, Albuquerque, N. M.

Quay County Good Roads Association, J. W. Coon, president, Tucumcari, N. M.; R. A. Prentice, secretary, Tucumcari, N. M.

New Mexico Good Roads Association, Ralph E. Twitchell, president, Santa Fe; D. R. Lane, secretary, Albuquerque.

Northern New Mexico Good Roads Association, L. S. Wilson, president, Raton; F. E. Van Dusen, secretary.

State Association of Highway Officials, Francis E. Lester, president, Mesilla Park; Harvey M. Shields, secretary, Raton.

Dona Ana County Good Roads Association, Francis E. Lester, president, Mesilla Park.

Lincoln County Good Roads Association, J. W. Laws, chairman, Lincoln.

New Mexico Association of Highway Officials, Francis E. Lester, president, Mesilla Park.

New York

New York State Road Builders Association, S. B. Van Wagenen, president, Rondout; John J. Ryan, secretary, 25 N. Pearl St., Albany.

North Carolina

Central Highway Committee, H. B. Varner, chairman, Lexington.

Charlotte-Wilmington Highway Association, A. B. Skelding, secretary, Wilmington.

North Carolina Good Roads Association, Joseph Hyde Pratt, secretary, Chapel Hill.

Anson County Good Roads Association, Dr. W. J. McLendon, president, Wadesboro; T. V. Howell, secretary-treasurer, Peachland.

Ashe County Good Roads Association, P. E. Fogle, president, Beaver Creek; W. E. Johnson, secretary, Beaver Creek.

Beaufort County Good Roads Association, George T. Leach, president, Washington; C. L. Morton, secretary-treasurer, Washington.

Bladen County Good Roads Association, O. L. Clark, president, Clarkton; W. J. Davis, secretary, Elizabethtown.

Asheville and Buncombe County Good Roads Association, E. C. Chambers, president, Asheville; B. M. Jones, secretary-treasurer, Asheville.

Burke County: Bridgewater Township Good Roads Association, W. Lyerly, president, Bridgewater; R. A. Abernathy, secretary-treasurer, Bridgewater.

Burke County Good Roads Association, J. E. Erwin, president. Morganton.

Connelly Springs Township Good Roads Association, Allis Coulter, president, Connelly Springs; J. L. Sides, secretary-treasurer, Connelly Springs.

Glen Alpine Township Good Roads Association, Dr. E. A. Hennessee, president, Glen Alpine; J. H. Giles, secretary-treasurer, Glen Alpine.

Hildebran Township Good Roads Association, J. W. Beach, president, Hildebran; A. L. Yoder, secretary-treasurer, Hildebran.

Caldwell County: Little River Township Good Roads Association, J. F. Steele, president, Lenoir, R.F.D. 2; F. M. Whitner, secretary, Lenoir, R.F.D. 2.

Camden County Good Roads Association, P. W. Stevens, president, Shiloh; E. I. Sawyer, secretary-treasurer, Camden.

Caswell County Good Roads Association, B. S. Graves, president, Yanceyville; J. W. James, secretary-treasurer, R. F. D. 1, Leasburg.

Carteret County Good Roads Association, C. S. Wallace, president, Morehead City; M. L. Willis, secretary-treasurer, Morehead City.

Catawba County Good Roads Association, R. L. Shuford, president, Newton, R. F. D. 1; R. P. Caldwell, secretary, Newton.

Chatham County Good Roads Association, James B. Atwater, president, Bynum; Frank D. Jones, secretary-treasurer, Gulf.

Chowan County Good Roads Association, J. H. McMullan, Jr., president, Edenton; H. L. Story, secretary-treasurer, Edenton.

Columbus County Good Roads Association, C. Herbert Smith, president, Acme, R. F. D.; K. Clye Council, secretary, Wananish.

Craven County Good Roads Association, R. A. Nunn, New Bern; W. G. Boyd, secretary, New Bern.

Cumberland County Good Roads Association, T. G. McAlister, president, Fayetteville; W. M. Walker, secretary-treasurer, Fayetteville.

Currituck County Good Roads Association, E. R. Johnson, secretary-treasurer, Currituck.

Davidson County: Abbots Creek Good Roads and Agricultural Association, C. D. Motsinger, president, Winston-Salem, R. F. D. 5; C. H. Teague, secretary, Wallburg.

Arcadia Good Roads and Agricultural Association, J. E. Hill, president, Lexington, F. R. D. 4; C. A. Kimel, secretary, Clemmons, R. F. D. 2.

Alleghany Good Roads and Agricultural Association, Robert Stokes, president, Newson; J. L. Doby, secretary, Newson.

Boone Good Roads and Agricultural Association, W. B. Meares, Linwood.

Cotton Grove Good Roads and Agricultural Association, J. D. Lockabill, president, Southmont; John L. Miller, secretary, Linwood, R. F. D. 2.

Denton Good Roads and Agricultural Association, Rev. Jefferson Lanning, president, Denton; J. M. Daniel, secretary, Denton.

Cid Good Roads and Agricultural Association, N. H. Prevo, president, Cid; D. A. Leach, Secretary, Denton.

Hampton Good Roads and Agricultural Association, John W. Hampton, president, Clemmons, R. F. D. 2; J. L. Nelson, secretary, Clemmons, R. F. D. 2.

Healing Springs Good Roads and Agricultural Association, James I. Smith, president, Silver Hill, R. F. D. 1; Hurley Daniel, Secretary, Denton, R. F. D. 1.

Holly Grove Good Roads and Agricultural Association, C. A. Swink, president, Lexington, R. F. D. 2; James F. Deal, secretary-treasurer, Lexington, R. F. D. 2.

Jackson Hill Good Roads and Agricultural Association, Stokes Smith, president, Newson; C. L. Bedgett, secretary, Jackson Hill.

Liberty Good Roads and Agricultural Association, T. G. Kindley, president, Lexington; John W. May, secretary, Hannersville.

Midway Good Roads and Agricultural Association, G. Frank Lindsay, president, Wallburg, R. F. D. 1; P. E. Whicker, secretary, Winston-Salem.

Reedy Creek Good Roads and Agricultural Association, P. E Fritts, President, Lexington; R. F. D. 4; J. A. Hendricks, secretary, Lexington, R. F. D. 4.

Silver Hill Good Roads and Agricultural Association, Joe Hedrick, president, Silver Hill; Grover C. Palmer, secretary, Silver Hill.

Thomasville Good Roads and Agricultural Association, S. H. Averett, president, Thomasville; L. E. Bird, secretary, Thomasville.

Tyro Good Roads and Agricultural Association, N. H. Swicegood, president, Lexington, R. F. D. 5; Charles F. Koontz, secretary, Linwood, R. F. D. 1.

Davidson-Randolph Highway Association, Arthur Ross, president, Asheboro; G. Dan Morgan, secretary-treasurer, Denton.

Davie County Good Roads Association, T. J. Byerly, president, Mocksville; E. D. Williams, secretary, Mocksville; C. F. Stroud, secretary, Mocksville.

Duplin County Good Roads Association, Island Creek, Island Creek Township; George R. Ward, president, Wallace; W. B. Brice, secretary-treasurer, Wallace.

Durham County Good Roads Association, Dr. A. Cheatham, president, Durham; P. C. Graham, secretary-treasurer, Durham.

Edgecombe County Good Roads Association, B. F. Shelton, president, Tarboro.

Forsyth County Good Roads Association, Judge H. R. Starbuck, president, Winston-Salem; A. F. Yarborough, vice-president, Winston-Salem.

Gates County Good Roads Association, Lycurgus Hofler, president, Gatesville; S. P. Cross, secretary-treasurer, Gatesville.

Greene County Good Roads Association, E. D. Little, president, Snow Hill, R. F. D. 6; J. E. Debman, secretary-treasurer, Snow Hill.

Guilford County Good Roads Association, J. Van Lindley, president, Greensboro; S. L. Trogden, secretary-treasurer, Greensboro.

Halifax County Good Roads Association, John L. Patterson, president, Roanoke Rapids; Charles J. Shields, secretary-treasurer, Scotland Neck.

Harnett County Good Roads Association, Dr. J. W. Halford, chairman, Chalybeate Springs; C. D. McNeely, secretary, Chalybeate Springs.

Haywood County Good Roads Association, F. W. Miller, president Waynesville; James Atkins, secretary, Waynesville.

Hertford County Good Roads Association, A. C. Vann, president, Ahoskie, W. A. Thomas, secretary, Cofield.

Johnston County Good Roads Association, W. M. Sanders, president, Smithfield; C. M. Wilson, secretary-treasurer, Wilson's Mills.

Benson Township Good Roads Association, P. B. Johnson, president, Benson; R. F. Smith, secretary-treasurer, Benson.

Jones County Good Roads Association, R. L. May, chairman, Trenton; John R. Barker, secretary-treasurer, Trenton.

Lee County Good Roads Association, J. B. Watson, president, Jonesboro; T. S. Cross, Secretary, Sanford.

Lenoir County Good Roads Association, Dr. J. M. Parrott, president Kinston; Rev. C. W. Howard, secretary-treasurer, Kinston.

Lincoln County G. R. Association, W. C. Kiser, president, Lincolnton; Tom. Cansler, secretary Lincolnton.

McDowell County: Old Fort Township Good Roads Association, Dr. F. H. Ihne, Graphiteville.

Macon County Good Roads Association, T. M. Green, president, Franklin.

Madison County Good Roads Association, Jasper Ebbs, president, Spring Creek; Dudley Chipley, secretary-treasurer, Marshall.

Hot Springs Township Good Roads Association, N. J. Lance, president, Hot Springs; S. W. Brown, secretary, Hot Springs.

Martin County Good Roads Association, W. C. Manning, president, Williamston; C. H. Godwin, secretary treasurer, Godwin.

Mecklenburg County Good Roads Association, F. M. Shannonhouse, secretary, Charlotte.

Mitchell County Good Roads Association, George K. Pritchard, chairman, Bakersville; W. C. Berry, secretary, Bakersville.

Montgomery County Good Roads Association, Frank Page, president, Biscoe; O. B. Deaton, secretary-treasurer, Troy.

Moore County Good Roads Association, Leonard Tufts, president, Pinehurst; J. R. McQueen, secretary-treasurer, Pinehurst.

Northampton County Good Roads Association, John E. Moore, president, Jackson; A. J. Connor, secretary-treasurer, Rich-Square.

Orange County Good Roads Association, Frank Nash, president, Hillsboro; secretary-treasurer, Hillsboro.

Pasquotank County Good Roads Association, W. J. Williams, president, Elizabeth City, R. F. D. 4; G. R. Little, secretary-treasurer, Elizabeth City.

Pender County Good Roads Association, George J. Moore, president, Atkinson; Laughlin McNeill, secretary-treasurer, Burgaw.

Perquimans County Good Roads Association, T. F. Winslow, president, Hertford; W. B. Hudson, secretary-treasurer, Hartford.

Person County Good Roads Association, W. E. Morton, president, Roxboro, R. F. D. 3; J. W. Noell, secretary, Roxboro.

Pitt County Good Roads Association, R. R. Cotten, president, Bruce; H. A. White, secretary-treasurer, Greenville.

Randolph County Good Roads Association, J. E. Williamson, president, Worthville; J. B. McCraig, secretary-treasurer, Asheboro.

Richmond County Good Roads Association, B. F. Reynolds, secretary-treasurer, Rockingham.

Robeson County Good Roads Association, A. E. White, secretary-treasurer Lumberton.

Rockingham County Good Roads Association, J. P. Richardson, president, Reidsville.

Rowan County Good Roads Association, P. B. Beard, president, Salisbury; J. H. Warburton, secretary, Salisbury.

Gold Hill Township Good Roads Association, J. W. Peeler, president, Rockwell.

Rutherford County Good Roads Association, Dr. John C. Twitty, president, Rutherfordton.

Stanley County Good Roads Association, J. M. Harris, Albemarle.

Stokes County Good Roads Association, John W. Kurfees, president, Germanton; Eugene Pepper, secretary, Danbury.

Surry County Good Roads Association, J. B. Sparger, president Mt. Airy; M. F. Butner, secretary-treasurer, Pinnacle.

Tyrrell County Good Roads Association, F. L. W. Cahoon, president, Columbia; H. S. Swain, secretary-treasurer, Jerry.

Union County Good Roads Association, W. C. Heath, president, Monroe; W. V. Love, secretary, Monroe.

Wake County Good Roads Association, Dr. J. M. Templeton, president, Cary; Col. Edward E. Brittain secretary-treasurer, Raleigh.

Washington County Good Roads Association, T. W. Blount, president, Roper; W. M. Bateman, secretary-treasurer, Plymouth.

Wayne County Good Roads Association, George C. Royall, president, Goldsboro; G. A. Norwood, secretary-treasurer, Goldsboro.

Wilkes County Good Roads Association, H. W. Horton, president, North Wilkesboro; Bruce Craven, secretary-treasurer, North Wilkesboro.

Yadkin County Good Roads Association, F. W. Hanes, chairman, Yadkinville; W. E. Rutledge, secretary, Yadkinville.

North Dakota

State Highway Improvement Association, Hon. L. B. Hanna, president, Bismarck; J. P. Hardy, secretary-treasurer, Fargo.

Ohio

Ohio Good Roads Federation, Jesse Taylor, president 515 Hartman Building, Columbus; A. H. Huston, secretary, 515 Hartman building, Columbus.

Franklin County Good Roads Association, E. A. Peters, president, Groveport; Wm. H. Maise, secretary, 406 Harrison Building, Columbus.

Greene County Good Roads Association, H. N. Ensign, president, Jamestown; R. S. Dean, secretary, R. F. D., Xenia.

Hamilton County Automobile Club, Dr. C. L. Bonefreeld, president, Gibson Home, Cincinnati; Dr. L. S. Colter, secretary, Gibson Home, Cincinnati.

Knox County Good Roads Association, H. C. Devine, president, Mt. Vernon; W. C. Rimer, secretary, Mt. Vernon.

Portage County Improvement Association, R. D. Hanna, president, Ravenna; C. R. Sharp, secretary, Ravenna.

Preble County Good Roads Association, C. W. Bloom, president, New Paris; C. G. Hawley, secretary, New Paris.

Scioto County Good Roads Association, L. Taylor, president, Rarden.

Wayne County Good Roads Association, Hon. Ed. S. Werts, president, Wooster.

Williams County Good Roads Association, Frank Dolph, president, West Unity; Hon. Wm. Behne, secretary, Bryan.

Belmont County: Joint Township Good Roads Committee, C. J. Allison, chairman, Bannock, Ohio.

Champaign County: Urbana Good Roads Committee, Joseph Murphy, chairman, Urbana, Ohio.

Guernsey County: Cumberland Good Roads Committee, Wm. T. Paterson, chairman, Cumberland, Ohio.

Highland County: Hillsboro Good Roads Committee, Capt. Chas. F. Clark, chairman, Hillsboro, Ohio.

Tuscarawas County: Dennison Good Roads Committee, Dr. E. A. Wolf, chairman, Dennison, Ohio.

Canal Dover Good Roads Committee, George E. Fertig, chairman, Canal Dover, Ohio.

Uhrichsville Good Roads Committee, S. W. Walter, chairman, Uhrichsville, Ohio.

Sandy Township Good Roads Committee, J. Ira Davy, chairman, Mineral City, Ohio.

New Philadelphia Good Roads Committee, James U. Congleton, chairman, New Philadelphia, Ohio.

Washington County: Salem Hall Good Roads Association, J. W. Pryor, president, New Matamoras, Ohio; S. J. Weddle, secretary, New Matamoras, Ohio.

Oklahoma

Oklahoma State Good Roads Association, W. R. Goit, president; C. C. Hudson, secretary, Oklahoma City.

Oregon

Oregon Development League, Theo. B. Wilcox, president, Portland; C. C. Chapman, secretary, Portland; W. S. Worden, chairman, Good Roads Committee, Klamath Falls.

Oregon Association for Highway Improvement, James Cole, vice-president Board of Trade Building, Portland; Philip S. Bates, secretary, 215 Oregonian Building.

Baker County: Huntington Development League, W. J. Woods, president, Huntington; J. E. Paul, secretary, Huntington.

Sumpter District Development League, L. C. Edwards, president, Sumpter; H. E. Hendrix, secretary, Sumpter.

Clackamas County: Canby Development League, R. A. Coe, president, Canby; H. H. Eccles, secretary, Canby.

Oak Grove Improvement Association, H. Thiessen, president, Williamette; J. D. Butler, secretary, Williamette.

Clatsop County: Hammond Development League, Sam Hanson, president, Hammond; William Potter secretary, Hammond.

Seaside Civic Improvement Club, Geo. E. Shaver, president, Seaside; V. M. Spurgeon, secretary, Seaside.

Koos County Good Roads Association, A. T. Morrison, president, Coquille.

Culver Development League, Wm. Boegli, president, Culver; D. B. Troutt, secretary, Culver.

Hampton Valley Improvement Association, A. T. Frame, president, Rolyat; V. Schroder, secretary, Rolyat.

Laidlaw Development League, J. N. B. Gerking, president, Laidlaw; Fred N. Wallace, secretary, Laidlaw.

Curry County Development League, Geo. D. Wood, manager, Gold Beach.

Douglas County Good Roads Association, Henry Hart, president, Roseburg; Carl D. Shoemaker, secretary, Roseburg.

Riddle Development League, R. C. Cutsforth, Riddle; T. W. Johnson, secretary, Riddle.

Grant County: Canyon Citizen's League, F. S. Slater, president, Canyon City; Otis Patterson, secretary, Canyon City.

Rhode Island

League of Improvement Societies in Rhode Island, Harry M. Mays, president, Edgewood; Luther D. Burlingame, secretary, 15 Catalpa Road, Providence.

South Carolina

South Carolina Road Builders Association, E. J. Watson, president, Columbia; W. C. Thomas, secretary, Columbia.

Georgia-Carolina Good Roads Association, E. J. Watson, president, Columbia.

Eastern Carolina Good Roads Association, H. H. Husbands, president, Florence.

South Carolina Good Roads Association, F. H. Hyatt, president, Columbia.

Abbeville County Good Roads Association, Dr. C. C. Gambrell, president, Abbeville.

Aiken County Good Roads Association, J. T. Shuler, president, Aiken.

Anderson County Good Roads Association, W. L. Brissey, president, Anderson.

Bamberg County Good Roads Association, S. G. Mayfield, president, Bamberg.

Barnwell County Good Roads Association, S. Z. Bryan, president, Allendale.

Calhoun County Good Roads Association, J. M. Moss, president, St. Matthew.

Charleston Automobile Club, J. M. Connelly, president, Charleston.

Cherokee County Good Roads Association, T. B. Butler, president, Gaffney.

Chester County Good Roads Association, John R. Alexander, president, Chester.

Dorchester County Good Roads Association, John A. Hiers, president, St. George.

Edgefield County Good Roads Association, S. B. Mays, president, Edgefield.

Fairfield County Good Roads Club, J. Q. Davis, president, Winnsboro; A. Homer Brice, secretary, Winnsboro.

Greenville County Good Roads Association, William G. Sirrine, president, Greenville.

Kershaw County Good Roads Association, M. C. West, president, Camden.

Lancaster County Good Roads Association, W. U. Clyburn, president, Camden.

Marion County Road and Highway Commission, L. D. Lide, clerk, Marion.

Newberry County Good Roads Association, Dr. W. C. Brown, president, Newberry.

Orangeburg County Good Roads Association, F. J. D. Felder, president, Orangeburg.

Pickens County Good Roads Association, W. T. O'Dell, president, Liberty.

Spartanburg County Good Roads Association, S. T. D. Lancaster, president, Pauline.
Sumter County Good Roads Association, S. A. Harvin, president, Sumter.
Union County Good Roads Association, J. H. Spears, president, Union.
Williamsburg County Good Roads Commission, J. A. Kelly, president, Kingstree.
York County Good Roads Association, R. T. Fewell, president, Rock Hall.

South Dakota

Chicago, Black Hills and Yellowstone National Park Highway Association, Division of South Dakota and Wyoming, N. E. Franklin, president, Deadwood, S. D.; H. W. Troth, secretary, Deadwood, S. D.
Sioux Falls-Salem-Iroquois Highway Association, L. V. Schneider, president, Salem; O. P. Schmidt, secretary-treasurer, Salem.
South Dakota Division of the Meridian Road, S. H. Edmunds, secretary, Yankton.
South Dakota Good Roads Association, J. W. Parmley, president, Ipswich; H. F. Brownell, secretary-treasurer, Sioux Falls.
South Dakota Scenic Highway Association, Harry Wentsy, president, Rapid City; E. K. Mather, secretary, Micthell.
Twin City-Aberdeen-Yellowstone Park Trail, J. W. Parmley, president, Ipswich; O. T. Peterson, secretary-treasurer, Hettinger, N. D.
Sioux Falls-Salem-Huron Road Association, W. F. Alguire, president, Ellis; Ray Bowden, secretary, Ellis.
Beadle County Good Roads Club, A. Lampe, president, Huron; J. McD. Campbell, secretary, Huron.
Hanson County: Alexandria Good Roads Club, John Munsen, president, Alexandria; John Dobson, secretary, Alexandria.
Hutchinson County: Meridian Road Club, A. A. Wipf, president, Freeman; A. J. Waltner, secretary, Freeman.
Lawrence County: Lead-Terry Good Roads Association, J. L. Curran, secretary, Lead.
Sioux Falls Good Roads League, J. L. White, secretary, Sioux Falls.
Roberts County Meridian Road Committee, Henry S. Morris, chairman, Sisseton.

Tennessee

Tennessee Highway Association, J. N. Fisher, president, Morristown; Cyrus Kehr, secretary, Knoxville.
Memphis-Bristol Highway Association, C. C. Gilbert, president, Memphis.
Western Tennessee Good Roads and Drainage Association, J. D. Johnson, president, Henderson.
Knoxville-Chattanooga Highway Association, S. H. Thompson, president, Athens.
Anderson County Good Roads Association, W. L. Owen, president, Clinton.
Bradley County Good Roads Association, J. W. Beard, president, Cleveland.
Cocke County Good Roads Association, chairman, W. D. McSween, Newport.
Fayette County Good Roads Association, E. A. Maddox, president, Somerville.
Grainger County Good Roads Association, Dr. A. E. Foster, president, Blaine.
Knox County Road and Park Association, Cyrus Kehr, president, 607 Empire Building, Knoxville.
Loudon County Good Roads Association, J. W. Norwood, president, Martel.
McMinn County Good Roads Association, R. J. Fisher, president, Athens.

Madison County Good Roads Association, R. A. Hurt, secretary, Jackson.
Monroe County Good Roads Association, Charles A. Lowry, president, Madisonville.
Roane County Good Roads Association, W. C. Shaw, president, Harriman.

Texas

Texas Good Roads Association, J. W. Warren, president, San Antonio; Homer D. Wade, secretary, Stamford.
Texas Industrial Congress, Henry Exall, president, Dallas, W. C. Barrickman, secretary, Dallas.
Texas Division of Meridian Highway
San Antonio to Galveston Division.
San Antonio-Laredo Division, D. E. Colp, president, Fort Worth; W. H. Beck, secretary, Fort Worth.
San Antonio-Laredo Highway, D. E. Colp, president, San Antonio; W. Trickey, secretary, Pearsall.
San Antonio-Atascosa and Gulf Highway Association, H. M. Martin, president, Pleasanton; W. L. Dunne, secretary, Pleasanton.
San Antonio-Port O'Connor Highway, J. W. Warren, president, San Antonio; W. H. Vernor, secretary, San Antonio.
San Antonio-Blanco and Granite Highway Association, Chas. E. Crist, president, Blanco City; R. E. Johnson, secretary, Marble Falls.
Gulf Coast Good Roads Association, J. H. Hawley, secretary-manager, Galveston.
East Texas Good Roads Association, G. A. Bodenheim, president, Longview; Dr. A. L. Hathcock, secretary, Palestine.
Alamo-Victoria-San Jacinto Highway, Judge J. P. Pool, president, Victoria; D. E. Colp, secretary, San Antonio.
Bell County: Good Roads Association, B. B. Buckeridge, secretary, R. L. Bennett, manager, Temple.
Bee County Good Roads Association, J. B. Daniels, secretary, Beeville.
Bexar County Highway Division of the San Antonio Chamber of Commerce, A. M. Fischer, president, San Antonio; D. E. Colp, secretary, San Antonio.
Blanco County Good Roads Club, Percy T. Brigham, president, Blanco City; Wily Kreuger, secretary, Twin Sisters.
Brazos County Good Roads Club, L. M. Hewitt, secretary, Bryan.
Burnett County Good Roads Association, C. A. Read, president, Marble Falls; M. E. Fabion, secretary, Marble Falls.
Cameron County Good Roads Association, S. C. Tucker, president, Brownsville; L. A. Whitney, secretary, Brownsville.
Colorado County: Eagle Lake Good Roads Club, Fritz Engelhart, president, Eagle Lake.
Crockett County: Ozona Good Roads Association, Chas. E. Davidson, secretary, Ozona.
Dallas County Good Roads Club, J. F. Zang, president, Dallas.
Falls County Good Roads Club, G. H. Carter, president, Marlin.
Guadalupe County Good Roads Club, J. M. Abbott, president, Seguin; C. F. Blumber, secretary, Seguin.
Guadalupe County Good Roads Association, Chas. Blumberg, president, Seguin; T. L. Abbott, secretary, Seguin.
Hopkins County Good Roads Club, F. W. Mack, secretary, Sulphur Springs.
Jefferson County Good Roads Club, T. W. Larkin, secretary, Beaumont.
Jim Wells County: Business Men's Good Roads Club, J. H. Briggs, president, Alice; Phil Hobbs, secretary, Alice.
Karnes County Good Roads Association, Dr. King, president, Karnes City; W. H. Howard, secretary, Karnes City.

Kendall County Good Roads Association, Dr. J. F. Nooe, president, Boerne; H. H. McFarland, secretary, Boerne.

Kerr County Good Roads Club, Mr. Schultz, secretary, Kerrville.

Lampasas County Good Roads Club, J. H. H. Berry, president, Lampasas; J. E. Verner, secretary, Lampasas.

Medina County: Devine Good Roads Club, J. W. Fullerton, president, Devine; Mack Kerchville, secretary, Devine.

Newton County Good Roads Association, I. B. Alford, president, Burkeville; L. M. Autrey, Newton, secretary.

Orange County Good Roads Association, Geo. W. Bancroft, president, Orange.

Robertson County: Calvert Good Roads Association, E. J. McGirick, secretary, Calvert.

Franklin Good Roads Club, F. S. Estes, Franklin.

Wilson County Good Roads Association, W. H. King, president, Stockdale, T. C. Richardson, secretary, Sutherland Springs.

Note: Practically every town of 5000 inhabitants or over has an active commercial club, and in every case these organisations act as good roads clubs and make the road propaganda one of their chief departments of work. They can be reached by addressing: Secretary, Commerical Club, at the town desired.

Vermont

Greater Vermont Association, Guy W. Bailey, president, Junction; J. P. Taylor, secretary, Burlington.

West River Valley Association, J. H. Ware, president, Townshend; H. C. Rice, secretary, Brattleboro.

Addison County: East Middlebury Improvement Society, Edward M. Day, president, East Middlebury; J. A. Douglas, secretary, East Middlebury.

Bennington County Improvement Association, Guy B. Johnson, president, Center; H. N. Morse, secretary, Manchester.

Arlington Village Improvement Society, Mrs. I. E. Bronson, secretary, Arlington.

Bennington County: North Bennington Improvement Association, Mrs. Edward D. Weeling, president, North Bennington; Myron H. Jones, secretary, North Bennington.

Rutland County: Danby and Mt. Tabor Improvement Society, W. H. Griffith, president, Danby; Mrs. Mabel Tabor, secretary, Danby.

Windsor County: Woodstock Improvement Society, F. T. Kidder, president, Woodstock; Miss Bertha S. Knapp, secretary, Woodstock.

Virginia

Virginia Road Builders' Association, C. B. Scott, president, Lynchburg; C. T. Scott, secretary, Waynesboro.

Richmond Society of Engineers, Arthur Scrivenor, president, Richmond; James Bolton secretary Richmond.

Amelia County Good Roads Association, H. F. Green, president, Amelia Court House.

Campbell County Good Roads Association, Eugene Ould, president, Evington; W. L. Garbee, Lawler.

Good Roads Association, Rustburg.

Charlotte County Good Roads Association, B. P. Eggleston, president, Charlotte Court House.

Chesterfield County Good Roads Association, Howard Swineford, president, Richmond.

Dinwiddie County Good Roads Association, J. E. Perkinson, chairman, Dinwiddie.

Fauquier County Good Roads Association, P. T. Crosby, president, Warrenton.

Halifax County Good Roads Association, W. Holt Edwards, president, Houston.

Lunenburg County Good Roads Association, E. P. Wallace, president, Meherrin.

Nansemond County Good Roads Association, R. H. Beamon, president, Beamon.

Pittsylvania County Good Roads Association, J. L. Carter, president, Chatham.

Shenandoah County Good Roads Association, M. H. Bowman, president, Woodstock.

Spotsylvania County: Fredericksburg Good Roads Association, E. D. Cole, president, Fredericksburg; Thomas H. Harris, secretary-treasurer, Fredericksburg.

Wise County Good Roads Association, John W. Chalkley, president, Big Stone Gap.

Washington

Washington State Good Roads Association, John A. Rea, secretary, Tacoma.

Chelan County Good Roads Association, Harry Shotwell, president, Wenatchee; H. A. Saunders, secretary, Wenatchee.

Clarke County: Dole Good Roads Association, C. H. Muncton, president, Dole; A. J. McPherson, secretary, Dole.

Ferry County Good Roads Associatin, W. T. O'Connell, president, Republic; S. H. Richardson, secretary, Republic.

Grant County Organization, William Ragless, president, Quincy; Leo G. Titus, secretary, Ephrata.

Island County: Good Roads Association of District No. 5, C. S. Halversen, president, R. D., Clinton; A. K. Hanson, secretary, R. D. Langley.

Kitsap County: Winslow Good Roads Association, Winslow.

Pearson Good Roads Association, W. H. Babcock, president, Pearson; G. Fryholm, secretary, Pearson.

Brownsville Good Roads Association, Jerry Beherns, president, Brownsville; T. U. Townsend, secretary, Brownsville.

Burley Improvement Club, H. W. Stein, secretary, Burley.

Kittitas County: Good Roads Association of Kittitas County, Soren Sorenson, president, Ellensburg; H. M. Hathaway, secretary, Ellensburg.

Klickitat County: Good Roads Association of Road District No. 4, J. S. Eddings, president Centerville; J. A. Miller, secretary Centerville.

Lincoln County Good Roads Association, Albert F. Kramer, president, Almira; Guy G. Harvey, secretary, Davenport.

Oroville Good Roads Association, Oroville.

Mason County: Matlock Good Roads Association, Fred Ferris, president, Matlock; M. J. Dunkelberger, secretary, Matlock.

Okanogan County Good Roads Association, George Bailey, secretary, Riverside.

Pierce County: Longbranch Good Roads Association & Improvement Club, S. S. Watkinson, secretary, Longbranch.

Skamania County: Underwood Good Roads Association, W. F. Cash, secretary, Underwood.

Hood Good Roads Association, F. W. Dehart, secretary, Hood.

Cook Good Roads Association, P. S. C. Wills, secretary, Cook.

Collins Good Roads Association, Alex. McKeighan, secretary, Collins.

Home Valley Good Roads Association, A. B. Hutcheson, secretary, Home Valley.

Butler Good Roads Association, F. S.. Munn, secretary, Butler.

Cape Horn Good Roads Association, M. B. Stevenson, secretary, Cape Horn.

Snohomish County Good Roads Association, Dr. W. C. Cox, Everett; W. W. Blaine, secretary, Everett.

Spokane County Good Roads Association, W.H. Cowles, president, Spokane; Frank W. Guilbert, secretary 411 Empire State Building, Spokane.

Walla Walla County: Good Roads Association, W. M. Cook, president, College Place; John Moyer, secretary, College Place.

West Virginia

Trans-Allegheny Good Roads Association, George W. Stevend, president, Richmond, Va.; Albert Sydney Johnson, secretary, Union, W. Va.

Southern West Virginia Good Roads Association, W. J. McClaren, president, Welch, W. Va.; E. L. Ellison, secretary, Beckley, W. Va.

Central West Virginia Good Roads Association, George Norris, president, Weston, W. Va.; John H. Long, secretary, Heater, W. Va.

West Virginia Good Roads Association, W. A. MacCorkle, president, Charleston, W. Va.; A. D. Williams, secretary, Morgantown, W. Va.

Cabell County Good Roads Association, G. A. Northcott, president, Huntington, W. Va.

Doddridge County Good Roads Association, G. W. Twyford, president, West Union, W. Va.; J. M. Martin, secretary, West Union, W. Va.

Fayette County Good Roads Association, P. M. Snyder, president, Oak Hill, W. Va.; E. J. Payne, secretary, Oak Hill, W. Va.

Greenbrier County Good Roads Association, Sam Price, president, Lewisburg, W. Va.; John S. Crawford, secretary, Lewisburg, W. Va.

Hampshire County Good Roads Association, G. K. Kump, president, Romney, W. Va.

Kanawha County Good Roads Association, C. C. Dickinson, president, Malden, W. Va.; C. C. Lewis, Jr., secretary, Charleston, W. Va.

Lewis County Good Roads Association, Stark A. White, president, R.F.D. 6, Weston, W. Va.

Marshall County Good Roads Association, A. H. Gray, president, Cameron, W. Va.; E. G. Gorby, secretary, Moundsville, W. Va.

Mason County Good Roads Association, R. P. Bell, president, Point Pleasant, W. Va.; P. T. Burdette, secretary, Point Pleasant, W. Va.

Mercer County Good Roads Association, Samuel Holroyd, president, Athens, W. Va.; C. T. Boykin, secretary, Bluefield, W. Va.

Mineral County Good Roads Association, J. C. Watson, president, Keyser, W. Va.; F. H. Babb, Keyser, W. Va.

Mingo County Good Roads Association, F. D. Pfenning, secretary, Williamson, W. Va.

Monroe County Good Roads Association, J. W. Lynch, president, Union, W. Va.; Albert Sydney Johnson, secretary, Union, W. Va.

Morgan County Good Roads Association, W. H. Summers, president, Berkeley Springs, W. Va.

Ohio and Brooks Counties Good Roads Association, Harry Sands, president, Wheeling, W. Va.; Roy B. Naylor, secretary, Wheeling, W. Va.

Pleasants County Good Roads Association, W. C. Carson, president, St. Marys, W. Va.

Pocahontas County Good Roads Association, C. B. Swecker, president, Dunmore, W. Va.

Randolph County Good Roads Association, W. G. Wilson, president, Elkins, W. Va.; James W. Wier, secretary, Elkins, W. Va.

Tyler County Good Roads Association, J. W. Duty, president, Middlebourne, W. Va.

Wayne County Good Roads Association, O. J. Ryfe, president, Wayne, W. Va.

Wetzel County Good Roads Association, L. E. Lantz, president, Jacksonburg, W. Va.; Smith Blair, secretary, Jacksonburg, W. Va.

Wood County Good Roads Association, Burdette Woodyard, president, Parkersburg, W. Va.; W. J. Alexander, secretary, Parkersburg, W. Va.

Wisconsin

Lake to River Association, Guido Hansen, president-treasurer, Milwaukee; Malcolm J. Mackinnon, secretary, Milwaukee.

Oconomowoc-Milwaukee Road Association, L. J. Petit, Wisconsin National Bank, Milwaukee.

Wisconsin Highway Commissioners' Association, H. J. Knelling, president, Pereles Building, Milwaukee; G. H. Mainwaring, secretary-treasurer Gotham.

Fox River Valley Highway Association, John Conway, president, Appleton, Wis.

Dane County: Madison Auto Good Roads Club, John Donald, president, Madison, Wis.; M. J. O'Malley, treasurer, Madison, Wis.

Lincoln County Good Roads Association, J. A. Emerich, president, Merrill, Wis.; W. D. Martin, secretary, Merrill, Wis.

Trempealeau County Good Roads Association, F. A. George, president, Whitehall; G. O. Linderman, vice-president, Osseo; J. A. Markham, secretary, Independence; Dr. G. H. Lawrence, treasurer, Galesville.

Wyoming

Association for promoting "Black Hills-Yellowstone Park Highway" N. E. Franklin, president, Deadwood, S. D.; J. D. Gallup, vice-president, Buffalo.

Northern Wyoming Good Roads Association, Hayden M. White, president, Buffalo; C. A. Harmon, secretary, Upton.

Wyoming Highway Association, Frank Wood, president, Casper; J. D. Kilborn, secretary, Elk Mountain.

Albany County Good Roads Association, Elmer Lovejoy, president, Laramie; Robert W. Innes, secretary, Laramie.

Carbon County Good Roads Association, Raymond Barber, president, Rawlins; Homer A. Menice, secretary, Rawlins.

Converse County: Good Roads Club of Douglas, Jacob Jenne, president, Douglas; Henry J. Bollin, secretary, Douglas.

Fremont County Good Roads Association. O. M. Beck, president, Lander, Wyo.; A. H. Maxwell, secretary, Lander, Wyo.

Laramie County Good Roads Association, H. P. Hynds, president, Cheyenne; C. A. Lane, secretary, Cheyenne.

MILEAGE OF IMPROVED AND UNIMPROVED ROADS

STATE	TOTAL MILEAGE	TOTAL MILEAGE IMPROVED	MILEAGE IMPROVED WITH STATE-AID
Alabama	49,639	5,491	313†
Arizona	5,987	354	278†
Arkansas	36,445	1,085	
California	48,069	8,788	600†
Colorado	30,571	304	655†
Connecticut	12,582	3,100	1,769*
Delaware	3,000	241	189†
Florida	17,954	2,525	
Georgia	83,986	12,500	
Idaho	18,408	611	100†
Illinois	94,141	9,000	185*
Indiana	63,370	26,831	
Iowa	104,027	2,505	
Kansas	98,302	374	
Kentucky	58,000	10,636	
Louisiana	24,962	697	300†
Maine	25,528	3,264	1,276†
Maryland	17,025	2,376	1,430*
Massachusetts	17,272	8,845	1,030*
Michigan	68,906	8,859	2,437†
Minnesota	79,323	6,206	1155†
Mississippi	44,072	1,800	
Missouri	107,923	6,507	
Montana	23,319	95	
Nebraska	80,338	249	
Nevada	12,751	62	
New Hampshire	15,116	2,025	1,024†
New Jersey	14,842	4,500	1,935†
New Mexico	16,920	705	110*
New York	80,112	22,398	5,156†
North Carolina	48,285	3,449	
North Dakota	61,593	161	
Ohio	83,681	28,312	415*
Oklahoma	71,325	499	
Oregon	35,896	4,941	
Pennsylvania	87,387	3,476	1,198†
Rhode Island	2,121	1,246	325†
South Carolina	45,549	4,888	
South Dakota	56,354	286	
Tennessee	45,913	5,354	
Texas	128,971	4,896	
Utah	7,970	1,653	952*
Vermont	14,406	3,078	1,431*
Virginia	43,399	3,732	2,905†
Washington	39,051	3,950	684†
West Virginia	32,109	541	
Wisconsin	61,090	11,163	1,436*
Wyoming	10,569	416	

* For the year 1913. † For the year 1914.

MANUFACTURERS

Manufacturers of Road Machinery and Equipment

Abenaque Machine Works (rock drills), F. H. Greaney, manager, Boston, Massachusetts.

Acme Equipment and Engineering Company, J. Webb Saffold, secretary, Cleveland, Ohio.

Acme Road Machinery Company, W. A. Cook, president and general manager; James W. Jones, treasurer; David B. Cook, secretary, Frankfort, N. Y.

Acme Wagon Company (dump wagon), Emigsville, Pennsylvania.

J. D. Adams and Company (roader, grader and tractor), W. R. Adams, assistant manager, Indianapolis, Indiana.

Albany Belting and Supply Company (bitumen heater), Matthew Van Alstyne, president; A. Y. Van Alstyne, vice-president; William D. Baker, secretary; Charles H. Hay, treasurer.

Allis-Chalmers Company (gyratory crusher), Otto H. Falk, receiver; H. Schifflin, manager, crushing and cement machinery department, Milwaukee, Wisconsin (advertisement page 155).

American Cement Machine Company, Inc. The (mixer), 10 Johnson Street, Keokuk, Iowa.

American Harrow Company, Detroit, Michigan.

American Process Company (rock and sand dryers), 68 Williams Street, New York City.

American Steel Scraper Company, W. F. Kilborn, general manager, Sidney, Ohio.

Ames Plow Company, Oliver Ames, president; Frederick B. Hill, Boston, Massachusetts.

Archer Iron Works (concrete mixer), 2400 34th Place, Chicago, Illinois.

Armstrong Manufacturing Company, Waterloo, Iowa.

Atlas Engineering Company (mixer), 790 Thirtieth Street, Milwaukee, Wisconsin.

Auburn Wagon Company, Lee Roy Myers, president; Max Robinson, treasurer and manager, Martinsburg, West Virginia.

Austin-Western Road Machinery Company, W. T. Beatty, president and general manager; W. I. Babb, vice-president and secretary; H. S. Maclay, treasurer; S. F. Beatty, assistant manager, Karpen Building, Chicago, Illinois (advertisement page 160).

Badger Concrete Mixer and Machinery Company, Watkins Building, Milwaukee, Wisconsin.

The Bain Wagon Company, W. W. Strong, Kenosha, Wisconsin.

A. D. Baker Company, A. D. Baker, vice-president, Swanton, Ohio.

The Baker Manufacturing Company (road graders), M. W. Baker, president, 337 W. Madison Street, Chicago, Illinois.

Ballou Manufacturing Company (concrete mixer), 124 High Street, Belding, Michigan.

Bethlehem Steel Company, Charles M. Schwab, president, South Bethlehem, Pennsylvania.

Bituminized Road Implement Company, Malden, Massachusetts.

Blystone Machinery Company, Cambridge Springs, Pennsylvania.

Bolte Manufacturing Company, The (mixer), Kearney, Nebraska.

The Browning Steam Shovel Company, main office and works, Mansfield, Ohio.

Bucyrus Company (steam shovels), W. W. Coleman, president; E. K. Surgart, vice-president; G. A. Morison, secretary; D. P. Ells, treasurer, South Milwaukee, Wisconsin.

Buffalo Pitts Company (road roller), F. G. Batchellor, sales manager, Buffalo, New York.

Buffalo Steam Roller Company, J. F. Richardson, sales manager, Buffalo, New York (advertisement page 164).

Bull Dog Dump Wagon Company The, 205–06 Boston Building, Kansas City, Missouri.

The Burch Plow Works Company, J. L. Morrow, secretary, Crestline, Ohio.

Butterworth and Lowe (concrete mixer), 17 Huron Street, Grand Rapids, Michigan.

The Call-Watt Company (road graders), Richmond, Virginia.

Canton Culvert Company, Julius H. Schlafly, president; Perry Van Horne, secretary, treasurer and general manager; Chas. Haines, vice-president and superintendent, Canton, Ohio.

Case Plow Works, J. I. (road plows and tractors), Racine, Wisconsin.

J. I. Case Threshing Machine Company, Frank K. Bull, president; F. Lee Norton, vice-president; Warren J. Davis, treasurer; Richards T. Robinson, secretary; W. W. Ramsey, general sales manager, Racine, Racine County, Wisconsin.

Cement Tile Machinery Company, The (concrete mixer), W. H. Stewart, Secretary, Waterloo, Iowa.

C. H. & E. Manufacturing Company, Inc. (gasoline engines and contractors' pumps), F. F. Hase, secretary and treasurer, Milwaukee, Wisconsin.

Chain Belt Company (concrete mixers), C. W. Levalley, president; Wm. C. Sargent, vice-president and secretary; Wm. C. Frye, treasurer, Milwaukee, Wisconsin.

Chamberlain Road Machine Company (graders, tractors and drags), Hutchinson, Minnesota.

Chicago Pneumatic Tool Company, George A. Rees, general manager, Fisher Building, Chicago, Illinois.

Cleveland Pneumatic Tool Company, The, Cleveland, Ohio.

Climax Road Machine Company, J. R. Manning, president; S. Jones Philips, vice-president; T. R. Clark, secretary-treasurer, Marathon, New York.

Columbia Wagon Company, W. T. Garrison, president; H. F. Yergey, treasurer and manager; Edward B. Smith, secretary, Columbia, Pennsylvania.

Concrete Form and Engine Company, 503 Wayne County Bank Building, Detroit, Michigan.

Cropp Concrete Machinery Company (concrete mixer), 118 N. La Salle Street, Chicago, Illinois.

Dauch Manufacturing Company (tractors), J. J. Dauch, president, Sandusky, Ohio.

Deere and Company (road plow), Moline, Illinois.

Denning Motor Implement Company, The (tractor), J. M. Denning, president, Cedar Rapids, Iowa.

Disc Grader and Plow Company, Allen L. Powlinson, president, Minneapolis, Minnesota.

Eagle Wagon Works, Frank E. Swift, president; Thomas M. Osborne, vice-president; Courtney C. Avery, secretary; Clarence F. Baldwin, treasurer, Auburn, New York.

The East Iron and Machine Company (portable asphalt paving plant), Lima, Ohio.
Elite Manufacturing Company (concrete mixer), E. L. Kilhefner, Ashland, Ohio.
Emerson-Brantingham Company, successors to The Geiser Manufacturing Company (road rollers), Waynesboro, Pennsylvania.
Enterprise Manufacturing Company (road roller), Columbiana, Ohio.
The Erie Machine Company, P. W. Dietley, manager, Erie, Pennsylvania.
E. D. Etnyre and Company, Oregon, Illinois.
Eureka Machine Company, Inc., Lansing, Michigan.
Everett Manufacturing Company (dumping boxes), 48 Lake Street, Newark, New Jersey.
Fairbanks, Morse and Company (tractors), Wabash Avenue and Eldredge Place, Chicago, Illinois.
Fairbanks Steam Shovel Company, Marion, Ohio.
A. B. Farquhar Company, Ltd. (engines), York, Pennsylvania.
Finley, Sam E. (oil distributor), Candler Building, Atlanta, Georgia.
Flinchbaugh Manufacturing Company (road roller), Greencastle, Pennsylvania.
Foote Manufacturing Company (concrete mixer), Nunda, New York.
Francis Machinery Company, 4 Market Street, St. Louis, Missouri.
Frick Company, Inc. (engines), A. O. Frick, president; Ezra Frick, vice-president and general manager; W. H. Manns, secretary; D. Norris Benedict, treasurer.
"Friend" Manufacturing Company, Casport, New York.
Galion Iron Works Company, David C. Boyd, president; G. L. Stiefel, vice-president; B. T. Moyer, secretary; F. W. Faber, treasurer, Galion, Ohio (advertisement page 171).
Gardner Crusher Company, Ed. E. Gauche, treasurer, 556 W. 34th Street, New York, New York.
Girnau Manufacturing Company, 121 South River Street, Eau Claire, Wisconsin.
Glen Wagon and Car Corporation, Cortland, New York.
Glen Wagon Works, Harry Glen, manager, Seneca Falls, New York.
Glide Road Machine Company, Clyde Waterman, president, Minneapolis, Minnesota.
Globe Machinery and Supply Company (road drags), Des Moines, Iowa.
Good Roads Machinery Company, Kennett Square, Pennsylvania (advertisement page 172).
Graves-Spears Road Machinery Company, D. E. Graves, vice-president, Oakland, California.
Griffith Iron Works Company, George Griffith, Jr., president, St. Louis, Missouri.
The Guelich Paving Company (street paving machine), Otto E. Guelich, president, 1412 Great Northern Building, Chicago, Illinois.
Gunn's Road Builder (grader), D. B. Gunn, Red Oak, Iowa.
Haiss Manufacturing Company, George (unloader), New York City.
Hall-Holmes Manufacturing Company (gasoline engine), 230 Oak Street, Jackson, Michigan.
The Hanna Manufacturing Company (engineering instruments), Troy, New York.
The Hart-Parr Company (tractor), C. W. Hart, president, Charles City, Iowa.
Haywood Wagon Company, John W. Haywood, general manager, Newark, New York.
Heider Manufacturing Company, Carroll, Iowa.
Hetherington and Berner (asphalt paving plants), Indianapolis, Indiana.

The Hobbs Concrete Machinery Company, N. F. Hobbs, sales-manager, Detroit, Michigan.

Holt Manufacturing Company (caterpillar engine), Peoria, Illinois (advertisement page 176).

Huber Manufacturing Company (road roller), S. E. Barlow, president and general manager; F. A. Huber, vice-president; E. C. L. Barlow, treasurer; E. Durfee, secretary, Marion, Ohio.

Humboldt Manufacturing Company (testing apparatus), 2014 Nebraska Avenue, Chicago, Illinois.

Chas. Hvass and Company (road machinery), B. Chas. Hvass, Wm. B. Lorenso, 509–11 East 18th Street, New York City.

Ideal Concrete Machinery Company, M. Wetzstein, president and treasurer; G. B. Pulfer, vice-president and general manager; G. B. Hopkins, secretary, South Bend, Indiana.

Imperial Machinery Company, Inc. (tractor), 1611 Central Avenue, Minneapolis, Minnesota.

Indiana Road Machine Company, Jno. M. Landenberger, president and treasurer; Chas. Stockman, Jr., secretary, Fort Wayne, Indiana.

Ingersoll-Rand Company (rock drills), W. L. Saunders, president; George Doubleday, vice-president; W. R. Grace, vice-president and treasurer; George R. Elder, vice-president; J. S. Phipps, vice-president; F. A. Brainard, secretary, 11 Broadway, New York City.

International Harvester Company of America (tractors), Harvester Building, Chicago, Illinois (advertisement page 178).

International Instrument Company, Arthur Kendrick, treasurer, 23 Church Street, Cambridge, Massachusetts (advertisement page 185).

Iroquois Iron Works, Arthur W. Sewall, president; A. D. Andrews, vice-president; Ira Atkinson, treasurer, Buffalo, New York.

Jaeger Machine Company (concrete mixer), Columbus, Ohio.

Jeffery Manufacturing Company, East First Avenue, Columbus, Ohio.

The Kelly Manufacturing Company (road drags), Waterloo, Iowa.

Kelly-Springfield Road Roller Company, Chas. M. Greiner, president, Springfield, Ohio.

The Kent Machine Company, M. L. Garrison, president; W. S. Kent, vice-president; F. H. Merrell, secretary-treasurer, Kent, Ohio.

Kent Mill Company (rock crusher), 10 Rapelyea Street, Brooklyn, New York.

Kentucky Wagon Manufacturing Company (dump wagons), Louisville, Kentucky.

The Kilbourne and Jacobs Manufacturing Company (scrapers and wheelbarrows), Columbus, Ohio.

The Kindling Machinery Company (street sweeper), H. Buchenberger, general manager, Milwaukee, Wisconsin.

Kinnard-Haines Company (gasoline tractor), O. B. Kinnard, 867 44th Avenue, Minneapolis, Minnesota.

Kinney Manufacturing Company (auto heater and distributor), J. Royal Kinney, president, 100 Boylston Street, Boston, Massachusetts (see advertisement page 181).

The Knickerbocker Company (mixers), W. B. Knickerbocker, Jackson, Michigan.

Koehring Machine Company, Wm. J. Koehring, president; Richard Keil, vice-president; P. Koehring, secretary-treasurer, 615–17 Germania Building, Milwaukee, Wisconsin (advertisement page 182).

Kolesch and Company, Inc. (surveyors' instruments), Emilie Kolesch, president; Percy A. Kolesch, treasurer, 138 Fulton Street, New York City.

Lansing Company, formerly Lansing Wheelbarrow Company (concrete mixers, etc.), E. W. Sparrow, president; F. Thoman, vice-president; A. C. Stebbins, secretary and general manager; H. E. Moore, treasurer Lansing, Michigan.

Lawrence Pump and Engine Company, Lawrence, Massachusetts.

Linder Grader Company, Paul C. Linder, Matthews, Indiana.

Link-Belt Company, Inc. (hoisting cranes), James M. Dodge, chairman; Charles Piez, president and treasurer; Glenn G. Howe, vice-president, Chicago, Illinois.

The Matchless Street Cleaner Company, Troy, New York.

E. J. McHarg and Company (concrete mixers), E. J. McHarg, L. R. McHarg, 3 Crandall Street, Binghamton, New York.

McKiernan-Terry Drill Company (rock drill), 117 Broadway, New York, New York.

McNutt Lewis (clay, sewer, block and pipe), 14 South Walnut Street, Brazil, Indiana.

Lourie Manufacturing Company, Springfield, Illinois.

Marion-Osgood Company (traction shovels), 51 State Street, Albany, New York.

Marion Steam Shovel Company, Geo. W. King, president and general manager; Frank A. Huber, vice-president and treasurer; R. H. Reidenbaugh, secretary, Marion, Ohio.

Marsh-Capron Manufacturing Company (concrete mixers), H. M. Capron, secretary, Old Colony Building, Chicago, Illinois.

Mayer Brothers Company, Mankato, Minnesota.

The Mercury Manufacturing Company, Chicago, Illinois.

Milburn Wagon Company, H. W. Suydam, president, Toledo, Ohio.

Milwaukee Concrete Mixer and Machinery Company, A. G. Bodden, secretary-treasurer, Milwaukee, Wisconsin.

Minneapolis Steel and Machinery Company (road tractor), Minneapolis, Minnesota.

Monarch Road Roller Company, Nat Tyler, Jr., president, Groton, New York.

N. S. Monroe and Sons (Monroe road machine), Arthur, Illinois.

Morse Twist Drill and Machine Company, New Bedford, Massachusetts.

Thomas Moulding Company, T. C. Moulding, Chicago, Illinois.

Municipal Engineering and Contracting Company (concrete mixers), F. C. Austin, president, 607-11 Railway Exchange Building, Chicago, Illinois,

Munnsville Plow Company, J. E. Sperry, president, Munnsville, New York.

New Holland Machine Company, P. S. Hess, secretary, New Holland, Pennsylvania.

The "New-Way" Motor Company, E. W. Goodnow, secretary, Lansing, Michigan.

Nims Concrete Machinery (concrete mixer), Philadelphia, New York.

Northwestern Steel and Iron Works (mixer). Thomas W. Resholt, vice-president, Eau Claire, Wisconsin.

Novo Engine Company, C. E. Bement, secretary and manager, Lansing, Michigan.

Ohio Ceramic Engineering Company (concrete mixers), Cleveland, Ohio.

The Ohio Manufacturing Company, A. B. Whitney, president and treasurer; W. E. Robinson, vice-president; Chas. C. Kouns, secretary, Upper Sandusky, Ohio.

The Ohio Road Machinery Company, W. A. Heusner, president; D. E. Graves, vice-president; C. H. Dudley, secretary-treasurer, Oberlin, Ohio.

Ohio Tractor-Roller Sales Company (tractor), W. W. Williams, president. 507-11 Brunson Building, Columbus, Ohio (see advertisement page 187).

Oliver Chilled Plow Works, South Bend, Indiana.

The Wm. J. Oliver Manufacturing Company (dump and spreader cars) Knoxville, Tennessee.

The Original Gas Engine Company, R. E. Olds, president; C. S. Smith, sales manager, Lansing, Michigan.

Oshkosh Manufacturing Company (concrete mixer), Oshkosh, Wisconsin.

Otto Gas Engine Works, 3411 Walnut Street, Philadelphia, Pennsylvania.

Overturf Mold and Mixer Company (mixers and culvert molds), Dumont, Iowa.

Owensboro Ditcher and Grader Company, W. R. Williams, sales-manager, Owensboro, Kentucky.

Pennsylvania Crusher Company, Stephen Girard Building, Philadelphia, Pennsylvania.

Peoria Metal Culvert Company (road finisher) East Peoria, Illinois.

Petrolithic Company, The, Los Angeles, California.

Pioneer Tractor Manufacturing Company, Winona, Minnesota.

Port Huron Engine and Thresher Company, C. F. Harrington, president; H. L. Stevens, vice-president; A. E. West, general manager; D. C. Kinch, secretary; J. T. Sullivan, treasurer, Port Huron, Michigan.

Power Mining Machinery Company. 115 Broadway, New York, New York.

Quenner Company, The (stone crusher), Mitts Quenner, president, 908 South Olive Street, Los Angeles, California.

Quincy Engine Company, I. C. Walk, general manager, Quincy, Pennsylvania.

Raber and Lang Manufacturing Company (mixers), 202 Mill Street, Kendallville, Indiana.

Ransome Concrete Machinery Company, A. W. Ransome, Dunellen, New Jersey.

Rapid Mixer Company, 84 Porter Block, Grand Rapids, Michigan.

Revolute Machine Company (blue printing machine), J. V. McAdam, president; C. J. Everett, treasurer; R. B. Snow, sales manager, 417 East 93d Street, New York City.

Roughen, P. (adjustable street gauge), 213 Amory Street, Fond Du Lac, Wisconsin.

Ruggles-Coles Engineering Company, Wm. B. Ruggles, president; Robt. G. McGann, vice-president; Lindsay R. Christie, secretary-treasurer, 50 Church Street, New York City.

Rumely Products Company (tractors), Clarence S. Funk, president, Michigan Boulevard Building, Chicago, Illinois.

Rural Road Machinery Company, The (road grader), Albert Akers, president, Quincy, Illinois.

The Russell Company, J. W. McClymonds, president; C. M. Russell, vice-president; E. C. Merwin, second vice-president and secretary; Geo. H. McCall, treasurer, Massillon, Ohio.

Russell Grader Manufacturing Company, E. E. Ellerston, president and manager; C. O. Wold, secretary-treasurer, Minneapolis, Minnesota (advertisement page 191).

Sanitary Street Flushing Machine Company, W. R. Anders, secretary, St. Louis, Missouri.

The Schaefer Manufacturing Company (concrete mixers), Park and Main Streets, Berlin, Wisconsin.

Shunk Plow Company, Bucyrus, Ohio.

Sidney Steel Scraper Company, The, William A. Perry, president, Sidney, Ohio.

Skow Manufacturing Company (road machinery), Newton, Iowa.

A. F. Smith Company, P. A. Smith, New Brighton, Pennsylvania.

T. L. Smith Company (concrete mixer), T. L. Smith, president; C. F. Smith, vice-president; W. J. Buckley, secretary-treasurer, 1304 Majestic Building, Milwaukee, Wisconsin.

Smith and Sons Manufacturing Company, William J. Smith, president; Kansas City, Missouri.

Southern Branch Petrolithic Company, New Orleans, Louisiana.

Spray Nozzle Company, George S. Crittenden, general manager, 205 Devonshire Street, Boston, Massachusetts.

R. H. Staley (tamping machines), Box 229, Springfield, Illinois.

Standard Manufacturing Company, Pliny E. Bassett, proprietor, Worcester, Massachusetts.

Standard Scale and Supply Company (concrete mixer), John C. Reed, president, 243 Water Street, Pittsburgh, Pennsylvania.

Sternberg Motor Truck Company (road truck), Victor L. Brown, vice-president, Milwaukee, Wisconsin (see advertisement page 195).

Stockland Road Machinery Company, A. G. Dunlop, president and treasurer, Minneapolis, Minnesota.

Studebaker Corporation (road machinery), J. M. Studebaker, president; Clement Studebaker, Jr., general manager; Geo. M. Studebaker, treasurer; A. R. Erksine, secretary, South Bend, Indiana.

Sturtevant Mill Company (generators), Thos. L. Sturtevant, president; Clayton and Park Streets, Boston, Massachusetts.

Sullivan Machinery Company (rock drills), F. K. Copeland, president; J. Duncan Upham, treasurer; Albert Ball, mechanical engineer; Thos. W. Fry, secretary, 150 Michigan Avenue, Chicago, Ill.

Syracuse Chilled Plow Company, Carlton A. Chase, president and treasurer; Wm. W. Ward, vice-president and secretary, Syracuse, New York.

Tarrant Manufacturing Company (road oiling appliances), W. P. Tarrant, president; W. R. Wilson, treasurer, Saratoga Springs, New York.

Taylor Road Inventions and Manufacturing Company, Denver, Colorado.

The Thew Automatic Shovel Company, F. A. Smith, president; R. Thew, vice-president and general manager; E. M. Pierce, treasurer, Lorain, Ohio.

The Tiffin Wagon Company, W. S. Shelly, manager, Tiffin, Ohio.

Tinius Olsen Testing Machine Company, Philadelphia, Pennsylvania (advertising page 207).

Traylor Engineering and Manufacturing Company (gyratory crushers), 30 Church Street, New York City.

Trautwein Dryer and Engineering Company, 417 South Dearborn Street, Chicago, Illinois.

The Troy Wagon Works Company, Troy, Ohio.

Twentieth Century Mixer Company, Norwood, Ohio.

Universal Crusher Company, 303 North 3d Street, Cedar Rapids, Iowa.

Union Iron Works, Lackawanna Siding, Hoboken, New Jersey.

Universal Road Machinery Company, R. E. Leighton, general manager, Kingston, New York (advertisement page 200).

U. S. Standard Manufacturing Company (concrete mixer), C. H. Snyder, secretary, Ashland, Ohio.

Utica Pipe and Foundry Company, Utica, New York.

Van Duzen-Roys Company (concrete mixer), Frank Van Duzen, president, Columbus, Ohio.

Van Nouhuys Machine Works (pumps), 41 Liberty Street, Albany, New York.

Virginia Bridge and Iron Company, C. Edwin Michael, president; T. T. Fishburne, vice-president and treasurer; Jno. R. Parker, secretary, Roanoke, Virginia.

Wallis Tractor Company, H. M. Wallis, Jr., secretary, Cleveland, Ohio.
Waterloo Cement Machinery Corporation (mixers, hoists and contractors, equipment) Waterloo, Iowa (advertisement page 203).
Watson Wagon Company, A. A. Keesler, president; C. M. Grouse, vice-president; Levi S. Chapman, secretary-treasurer, Canastota, New York.
Western Wheeled Scraper Company, W. I. Babb, president; W. D. Foulke, treasurer; Frank C. Worthington, secretary, Aurora, Illinois.
Wheeling Mold and Foundry Company (rock crusher), Leroy A. Kling, sales manager, Wheeling, West Virginia.
White Company, The (road truck), Windsor T. White, president, Cleveland, Ohio (see advertisement page 204).
Whitman Agricultural Company, H. L. Whitman, 6930 South Broadway, St. Louis, Missouri.
Wiard Plow Company, Arthur G. Hough, president, Batavia, New York.
Wichita Concrete Machinery Company, 232 N. Sante Fe Avenue, Wichita, Kansas.
Wood Drill Works, Paterson, New Jersey.
The F. B. Zieg Manufacturing Company (culverts), Fredericktown, Ohio (advertisement page 207).

Manufacturers of Road Material and Engineering Equipment

Ainsworth and Sons, Wm. (engineering instruments), Denver, Colorado.
Alcott, Edward (white oak key and wood block), Manassas, Virginia.
Alden Speare's Sons Company (road oils), Boston, Massachusetts.
American Bridge Company of New York, George L. Denio, chief clerk, Hudson Terminal, 30 Church Street, New York City.
American Casting Company (culverts), D. B. Dimick, president, Birmingham, Alabama.
American Cast Iron Pipe Company, Birmingham, Alabama (advertisement page 166).
American Drafting Furniture Company, F. W. Barkley, vice-president, Rochester, New York.
American Granite Company, Otto Rathman, president, Milwaukee, Wisconsin.
American Paving and Manufacturing Company, Indianapolis, Indiana.
American Rolling Mill Company (culvert iron), Middletown, Ohio (advertisement page 188).
American Steel and Wire Company (steel reinforcement), 72 West Adams Street, Chicago, Illinois.
American Tar Products, S. H. Bingham, president, 208 South LaSalle Street, Chicago, Illinois.
Amies Asphalt Company, Dr. Joseph H. Amies, 1520 Chestnut Street, Philadelphia, Pennsylvania.
Amies Road Company, John Rice, president; W. T. Newcomb, engineer, Drake Building, Easton, Pennsylvania.
American Sheet and Tin Plate Company (culverts), H. V. Jamison, manager, Pittsburgh, Pennsylvania (advertisement page 157).
American Tar Company, Charles P. Price, manager; road department, 201 Devonshire Street, Boston, Mass. (advertisement page 154).
Arnott, Lee (culvert pipe), 518 Little Building, Lincoln, Nebraska.
Asphalt Block and Pavement Company (blocks and tiles), Ohio Building, Toledo, Ohio.
Atlanta Gas Light Company, R. C. Congdon, manager, Electric and Gas Building, Atlanta, Georgia.
Atlantic Refining Company, The, J. W. Van Dyke, president; W. P. Cutler, vice-president; W. M. Irish, secretary, and Henry S. Mustin, treasurer, 3144 Passyunk Avenue, Philadelphia, Pa.

Atlantic Westrumite Company, Inc., J. H. Cranford, president; R. Y. Filbert, vice-president; A. H. Putnam, secretary and treasurer, 2620 E Street N.W., Washington, D. C.

Attica Bridge Company, Attica, Indiana.

Austin Brothers (bridges, machinery), Dallas, Texas and Atlanta, Georgia (see advertisement page 159).

R. D. Baker Company (expansion joints), R. D. Baker, president, 73 Home Bank Building. Detroit, Michigan (advertisement page 161).

Barber Asphalt Paving Company, Charles W. Bayliss, manager road department, Land Title Building, Philadelphia, Pennsylvania (advertisement page 162).

Barrett Manufacturing Company. F. S. Hutchinson, manager Tarvia department, 17 Battery Place, New York, New York (advertisement page 163).

Bausch and Lomb Optical Company (instruments), Rochester, New York

Baker and Lockwood Manufacturing Company (tents), Kansas City, Missouri.

The L. Beckmann Company (surveyors' instruments), 600 Adams Street, Toledo, Ohio.

Beecher Draft Spring Company, New Haven, Connecticut.

C. L. Berger and Sons (surveyors' instruments), 37 Williams Street, Boston, Massachusetts.

The Binder Company (road oils), John H. Hurlbutt, president, 82 Beaver Street, New York, New York.

Birdsboro Stone Company, Chas. A. Bergdoll, president; Robt. MacBurney, general manager; E. C. Bergdoll, treasurer; Albert T. Hall, secretary, 614 Bulletin Building, Philadelphia, Pennsylvania.

Birmingham Rail and Locomotive Company (locomotives and steam shovels), Birmingham, Alabama.

Bituminised Road Company (pavement manufacturer); Reliance Building, Kansas City, Missouri (advertisement page 165).

Bituminous Products Company ("Besco" expansion joint), 378 Woodward Avenue, Detroit, Michigan.

Rudolph S. Blome Company (paving block), Rudolph S. Blome, president; City Hall Square Building, Chicago, Illinois.

Braden Culvert Company, Terre Haute, Indiana.

F. E. Brandis Sons Company (surveyors' instruments), 610–614 Gates Avenue, Brooklyn, New York.

The British American Oil Company, Ltd., S. R. Parsons, president, Toronto, Ontario, Canada.

Buff and Buff Manufacturing Company (surveyors' instruments), Jamaica Plains, Massachusetts (advertisement page 159).

Edward E. Buhler Company (supplies), Edward E. Buhler, president and general manager, 103 Park Avenue, New York City.

Burton Powder Company, J. Burton, president, Pittsburgh, Pennsylvania.

Butler Manufacturing Company (culverts), Chas. R. Butler, president; John D. Stevens, secretary and treasurer; E. E. Norquist, superintendent, Minneapolis, Minnesota.

Byerley and Sons (road oils), Frank A. Byerley, Cleveland, Ohio.

Cannelton Sewer Pipe Company, H. H. Clemens, secretary, Cannelton, Indiana.

The Philip Carey Company (expansion joints), George D. Crabbs, president; R. B. Crabbs, vice-president; E. L. Buse, secretary, Cincinnati, Ohio (advertisement page 185).

Carnegie Steel Company (crushed slag and bridge steel), Pittsburgh, Pennsylvania.

Champion Bridge Company, Wilmington, Ohio.

Chattanooga Sewer Pipe and Fire Brick Company (culverts), O. E. Deppen, vice-president, Chattanooga, Tennessee.

Chicago Steel Tape Company, L. A. Nichols, president, 6229–6233 Cottage Grove Avenue, Chicago, Illinois.

Clip-Bar Manufacturing Company (curb guard), Philadelphia, Pennsylvania.

J. B. Clow and Sons (cast iron culvert pipe), Chicago, Illinois (advertisement page 166).

Coast Culvert and Flume Company, James S. Beall, Portland, Oregon.

Concrete Guard Rail Company, J. Y. McClintock, manager, Rochester, New York.

The Conneaut Shovel Company, G. W. Benton, secretary, Conneaut, Ohio.

Consolidated Metal Expanded Company (reinforcement bars), Park Avenue and 40th Street, New York City.

The Continental Bitumen Company, Toledo, Ohio.

Continental Bridge Company, Chicago, Illinois.

Corrugated Bar Company, Mutual Life Building, Buffalo, New York (advertisement page 167).

Craig Oil Company, The, 316 Gardner Building, Toledo, Ohio.

Creosoted Wood Block Paving Company, R. S. Manley, president, New Orleans, Louisiana.

F. D. Cummer and Sons Company, Cleveland. Ohio.

Cyclone Drill Company, Orrville, Ohio.

Detroit Graphite Company (bridge paint), 10 Twelfth Street, Detroit, Michigan.

Dickey Clay Manufacturing Company, W. S. (culverts), Walter S. Dickey, president, 200 New York Life Building, Kansas City, Missouri.

Eugene Dietzgen Company (surveyor's instruments), 214–220 East 23d Street, New York City.

Dixie Culvert and Metal Company, H. P. Smith, vice-president; Atlanta, Georgia (see advertisement page 173).

Donaldson Iron Company, Emaus, Pennsylvania (advertisement page 166).

E. I. du Pont de Nemours Powder Company, Wilmington, Delaware.

The Dustoline for Roads Company, Jno. S. Lamson, Jr., president; Edwin R. Lamson, vice-president; W. J. Lamson, treasurer; Fred L. LaRowe, secretary. Summit, New Jersey.

The Equitable Asphalt Maintenance Company, F. H. Moore, secretary-treasurer, Commerce Building, Kansas City, Missouri.

C. L. Farnsworth Company (engineering instruments), 23 Central Street, Boston, Massachusetts.

Farris Bridge Company, William Farris, president, Jenkins Arcade Building, Pittsburgh, Pennsylvania.

W. H. Filer Company (sign boards), 337 Jackson Street, Grove City, Pennsylvania.

Fort Dodge Culvert Company, Sioux City, Iowa.

The France Stone Company, L. H. Hawblitz, Ohio Building, Toledo, Ohio (advertisement page 208).

Louis Frey and Company (surveyors' instruments), A. H. Honaker, manager, 116 Williams Street, New York, New York.

Fibred-Asphalt Company, George A. Henderson, St. Albans, West Virginia.

Fulcher Concrete Block and Paving Company, D. G. Donahue, secretary, Oakland, California.

Gafford Culvert and Machinery Company, The, San Antonio, Texas.

Gilsonite Construction Company, 721 Wainwright Building, St. Louis, Missouri.

Glamorgan Pipe and Foundry Company (cast iron culvert pipe), Lynchburg, Virginia (advertisement page 166).

The Glidden Varnish Company, Cleveland, Ohio.

Greenberg Iron Company, A. L. (culverts), C. V. Joseph, manager sales department, Terre Haute, Indiana (see advertisement page 170).

W. and L. E. Gurley (surveyors' instruments), Troy, New York (advertisement page 173).

Harry Brothers Company (metal culverts), Newport, Kentucky.
O. K. Harry Steel Company, 2340–42 Papin Street, St. Louis, Missouri.
Hartford Paving and Construction Company (culverts), Hartford, Connecticut.
The Hastings Pavement Company, E. J. Morrison, president and general manager; O. A. Palmer, treasurer; C. P. Pults, secretary, 25 Broad Street, Broad-Exchange Building, New York, New York (advertisement page 175).
Hassam Paving Company, Matthew J. Whittall, president; Harold Parker, vice-president; Alfred Thomas, treasurer; Walter E. Hassam, general manager, Slater Building, Worcester, Massachusetts.
Headley Good Roads Company (road oils), W. T. Headley, president; 30th and Spruce Streets, Philadelphia, Pennsylvania (advertisement page 177).
The Hennepin Bridge Company, Minneapolis, Minnesota.
Charles M. Higgins and Company (copying ink), Brooklyn, New York.
The Highway Culvert Form Company, 100–2 Madison Street, Ottawa, Illinois.
Hotchkiss Lock Metal Form Company, M. S. Hotchkiss, president, Binghamton, New York.
Huasteca Petroleum Company, A. R. Knight, sales manager, Whitney Bank Building, New Orleans, Louisiana.
Illinois Bridge Company, H. E. Williams, president, 1629 Monadnock Block, Chicago, Illinois.
Independent Powder Company of Missouri, N. P. Rood, president, Joplin, Missouri.
The Indestructible Sign Company. Columbus, Ohio.
Inland Steel Company (culverts), George H. Jones, secretary, First National Bank Building, Chicago, Illinois.
International Asphalt Company, Chamber of Commerce Building, Chicago, Illinois..
Jefferson Powder Company, Atlanta, Georgia.
Jennison-Wright Company, Toledo, Ohio.
Kalamazoo Foundry and Machine Company (culverts), Kalamazoo, Michigan.
Keystone National Powder Company, Emporium, Pennsylvania.
Kueffel and Esser (surveyors' instruments), Hoboken, New Jersey.
Klauer Manufacturing Company (culverts), W. H. Klauer, secretary, 110 South Dearborn Street, Chicago, Illinois.
Ledder and Probst (surveyors' instruments), Boston, Massachusetts.
F. J. Lewis Manufacturing Company (road oils), 2500 South Robey Street, Chicago, Illinois.
The Lufkin Rule Company, A. M. Marshall, president, Saginaw, Michigan.
Luten, Daniel B. (concrete bridges), Indianapolis, Indiana (see advertisement page 184).
Lynchburg Foundry Company (cast iron culvert pipe), Lynchburg, Virginia (advertisement page 166).
Marsh Engineering Company (bridge builders), Des Moines, Iowa.
Massillon Iron and Steel Company, Massillon, Ohio (advertisement page 166).
Memphis Bridge Company, Memphis, Tennessee.
Memphis Stone and Gravel Company, Memphis, Tennessee.
Merrillat Culvert Core Company (culvert forms), C. C. Merrillat, general manager, Winfield, Iowa.
Mexican Petroleum Company, Ltd., Edward L. Doheny, president, 52 Broadway, New York City.
Michigan Bridge and Pipe Company, Lansing, Michigan.
The Midland Bridge Company, 504–10 Midland Building, Kansas City, Missouri.

Morrison Tent and Awning Company, 115-17 Olive Street, St. Louis, Missouri.

National Concrete Company, 805 Traction Terminal Building, Indianapolis, Indiana.

National Pavement Company of New York, 30 Church Street, New York City.

National Tracing Cloth Company, Saylesville, Rhode Island.

National Tube Company, Wm. B. Schiller, president, Pittsburgh, Pennsylvania.

Neuchatel Asphalt Company, Ltd., The, C. Pollard Urquhart, manager, 79 Tompkins Street, New York City.

Newport Rolling Mill Company, Frank A. Moesch, sales manager, Newport, Kentucky.

Northfield Iron Company, 422 Water Street, Northfield, Minnesota.

North Western Expanded Metal Company (reinforcement bars), Old Colony Building, Chicago, Illinois.

Oregonia Bridge Company, The, Thomas R. Spencer, president, Lebanon Ohio.

Orenstein-Arthur Koppel Company (dump cars), 30 Church Street, New York, New York (advertisement page 189).

The Pennsylvania Steel Company, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.

Pennsylvania Trojan Powder Company, Allentown, Pennsylvania.

Portsmouth Culvert Company, N. J. Ewing, president, Portsmouth, Ohio.

Prudential Oil Corporation, R. W. Sanders, sales manager, 17 Battery Place, New York City.

Quick Unloading Car Chute Company, 807 Title Building, Birmingham, Alabama.

Republic Creosoting Company, P. C. Reilly, Indianapolis, Indiana.

Roanoke Bridge Company, Inc., Roanoke, Virginia.

Robeson Process Company, J. S. Robeson, president, 18 East 41st Street, New York City (advertisement page 191).

Rock Island Bridge and Iron Works, Rock Island, Illinois.

Rocmac Road Corporation (road binder) 860 Leader-News Building, Cleveland, Ohio.

E. G. Ruehle (surveyors' instruments), 119 Fulton Street, New York City.

Salfisberg, J. E. and Company (engineering instruments), Aurora, Illinois.

San Antonio Sewer Pipe Works, San Antonio, Texas.

R. Seelig and Sons (engineering instruments), 329 North Fifth Avenue, Chicago, Illinois.

The Shannon Self-Locking Metal Culvert, George G. McGlaughlin, Cincinnati, Ohio.

Shelby Downward Asphalt Company, Ardmore, Oklahoma.

Sicilian Asphalt Paving Company, Howard Carroll, president; Harry Haggerty, secretary; George C. Clausen, treasurer, 41 Park Row and 12th Avenue and 54th Street, New York City.

E. G. Soltman (surveyors' instruments), 134 West 29th street, New York City.

Semet-Solvay Company, Fredk. R. Hazard, president; Rowland G. Hazard, vice-president; L. O. MacDaniel, treasurer; Geo. E. Francis, secretary, Syracuse, New York.

Southern Sewer Pipe Company, J. A. Millson, manager, Birmingham, Alabama.

Southern Wood Preserving Company, R. H. White, president, Atlanta, Georgia.

Standard Asphalt and Rubber Company, E. G. Lessynsky, president, 208 South LaSalle Street, Chicago, Illinois.

Standard Cast Iron Pipe Company, Bristol, Pennsylvania.

Standard Oil Company of New Jersey, 26 Broadway, New York City (advertisement page 192).

Standard Oil Company of New York, 26 Broadway, New York City (advertisement page 194).

Stanford-Crowell Company (sign boards), W. H. Crowell, president, Ithaca, New York.

Stark, N. M. ana Company (bridge builders), Des Moines, Iowa.

Steel Protected Concrete Company, H. A. Miner, president, Real Estate Trust Building, Philadelphia, Pennsylvania (advertisement page 193).

Sun Company, J. N. Pew, Jr., president, 1421 Chestnut Street, Morris Building, Philadelphia, Pennsylvania.

Sweeney and Gray (road supplies), J. A. Gray, manager, 61 Sixth Street, Long Island City, New York.

Thomas Steel Reinforcement Company (reinforcing bars), Majestic Building, Detroit, Michigan.

Traub and Helfrecht (culvert), Germania, Pennsylvania.

Tennessee Metal Culvert Company, L. G. Boxwell, secretary, Nashville, Tennessee.

Texarkana Pipe Works (culverts), Texarkana, U. S. A.

Trussed Concrete Steel Company, Detroit, Michigan.

Universal Drafting Machine Company, Cleveland, Ohio.

Union Clay Products Company (culverts), New Brunswick, New Jersey.

Union Oil Company of California, Wm. L. Soleau, comptroller; Alexander Sclater. manager, sales department, Union Oil Building, Los Angeles, California.

U. S. Asphalt Refining Company, O. E. Thurber, vice-president; Geo. L. Whitney, secretary; Jos. R. Draney, sales manager, 90 West Street, New York City (advertisement page 197).

U. S. Cast Iron Pipe and Foundry Company, L. R. Lemoine, president; Geo. J. Long, vice-president; B. F. Haughton, secretary and treasurer, Morris Building, Philadelphia, Pennsylvania (advertisement page 196).

U. S. Wood Preserving Company, 165 Broadway, New York City (advertisement page 198).

The United Gas Improvement Company, Samuel T. Bodine, president; Paul Thompson, vice-president; Walter H. Fulweiler, manager, road department, Philadelphia, Pennsylvania.

The Wadsworth Stone and Paving Company. W. C. Thoma, president and general manager; J. A. Siedle, secretary and treasurer, Lambert Street and Pennsylvania Railroad, Pittsburgh, Pennsylvania.

Waring-Underwood Company (Ideal expansion joint), Commercial Trust Building, Philadelphia, Pennsylvania.

Warner-Quinlan Asphalt Company, W. W. McFarland, sales manager, 7 Wall Street, New York (advertisement page 201).

Warren Brothers Company, George C. Warren, president and general manager; Chas. W. Young, vice-president; Ralph H. Warren, treasurer; Albert C. Warren, secretary, 59 Temple Place, Boston, Massachusetts (advertisement page 202).

Washington Block and Asphalt Tile Company, R. H. Johnson, president, Washington, D. C.

Wern Stone Paving Company, (granite blocks), 80 Church Street, New York City.

Western Bridge and Construction Company, Bee Building, Omaha, Nebraska.

Westrumite Company, The, J. A. Gill, president; G. S. van Westrum, vice-president; J. H. Fowler, secretary; F. J. Smith, treasurer, all at Whiting, Indiana.

Whalen Form (culvert forms) Edward J. Whalen, Syracuse, New York (advertisement page 205).

R. D. Wood and Company (cast iron culvert pipe), Philadelphia, Pennsylvania.

The Wycoff Pipe and Creosoting Company, 48 Church Street, New York City.

Wyoming Shovel Works, Wyoming, Pennsylvania.

York Bridge Company, York, Pennsylvania.

Young and Sons (engineering instruments), Philadelphia, Pennsylvania.

Dealers in or Agents for Road Making Machinery and Material

Austin Machinery Company, W. E. (contractors equipment), W. E. Austin, president, 2 Spring Street, Atlanta, Georgia.

Bacon, Edward R. (contractors equipment), 38–40 Natoma Street, San Francisco, California.

Baker Jr., John (oils), 17 Battery Place, New York City.

James S. Barron, 127 Franklin Street, New York City.

C. N. Carpenter Supply Company (grader, scraper, spreader and leveler), Canton, Ohio.

Good Roads Supply Company, Horatio S. Earle, president; Earl I. Heenan, vice-president; L. J. Brown, secretary and treasurer; Ford Building, Detroit Michigan.

Harold L. Bond Company, of New York, Harold L. Bond, president; Howard C. Weaver, secretary-treasurer; Geo. S. Hedge, vice-president; 78-80 Bridge Street, New York City.

Henry J. McCoy Company, Henry J. McCoy, president; Jas. W. McCoy, vice-president; John G. Wentink, treasurer; Frank E. Hall, secretary, 65 Dey Street, New York City.

The Good Roads Machinery Company, Kennett Square, Pennsylvania.

Lima Contractors Supply Company, Delphos, Ohio.

Geo. E. Ritchey Supply Company, Columbus, Ohio.

Road Supply and Metal Company, F. L. Carswell, secretary, Topeka, Kansas.

Shannon and Company, J. Jacob (contractors equipment), Leon Rosenbaum, secretary, 1744 Market Street, Philadelphia, Pennsylvania.

Association of American Portland Cement Manufacturers

Officers.—John B. Lober, president, president Vulcanite Portland Cement Company, Land Title Building, Philadelphia, Pa.; Robest S. Sinclair, vice-president, vice-president Alsen's American Portland Cement Works, 45 Broadway, New York City; Chas. F. Conn, treasurer, president Giant Portland Cement Co., 604 Pennsylvania Building, Philadelphia, Pa.; Percy H. Wilson, secretary, 808 Bellevue Court, Philadelphia, Pa.

Headquarters.—808 Bellevue Court, Philadelphia, Pennsylvania.

Objects.—To acquire and disseminate information concerning the best practice in the use of cement and concrete.

To raise the standards of construction.

To emphasise the necessity of careful attention to all details of construction and to the selection of such materials as will produce the best results.

To give to anyone requesting same, information they may desire on the proper use of cement and concrete.

Portland Cement Manufacturers

Allentown Portland Cement Company, Allentown, Pennsylvania.
Alpha Portland Cement Company, Easton, Pennsylvania.
Alsen's American Portland Cement Works, 45 Broadway, New York City.
Ash Grove Lime and Portland Cement Company, Grand Ave. Temple, Kansas City, Missouri.
Atlas Portland Cement Company, 30 Broad Street, New York City, New York.
Bath Portland Cement Company, Newark, New Jersey.
Cape Girardeau Portland Cement Company, Cape Girardeau, Missouri.
Castalia Portland Cement Company, Publication Building, Pittsburgh, Pennsylvania.
Cayuga Lake Cement Company, Ithaca, New York.
Chicago Portland Cement Company, 30 N. LaSalle Street, Chicago, Illinois.
Clinchfield Portland Cement Corporation, Kingsport, Tennessee.
Colorado Portland Cement Company, Denver, Colorado.
Continental Portland Cement Company, St. Louis, Missouri.
Coosa Portland Cement Company, Ragland, Alabama.
Coplay Cement Manufacturing Company, Land Title Building, Philadelphia, Pennsylvania.
Crescent Portland Cement Company, Wampum, Pennsylvania.
Dewey Portland Cement Company, Scarritt Building, Kansas City, Missouri.
Dexter Portland Cement Company, Nazareth, Pennsylvania.
Diamond Portland Cement Company, Williamson Building, Cleveland, Ohio.
Dixie Portland Cement Company, Chattanooga, Tennessee.
Edison Portland Cement Company, Stewartsville, New Jersey.
German-American Portland Cement Works, La Salle, Illinois.
Giant Portland Cement Company, 604 Pennsylvania Building, Philadelphia, Pennsylvania.
Glens Falls Portland Cement Company, Glens Falls, New York.
Helderberg Cement Company, Albany, New York.
Huron Portland Cement Company, Ford Building, Detroit, Michigan.
Iola Portland Cement Company, Iola, Kansas.
Iowa Portland Cement Company, Des Moines, Iowa.
Ironton Portland Cement Company, Ironton, Ohio.
Kosmos Portland Cement Company, Kosmosdale, Kentucky.
Lehigh Portland Cement Company, Allentown, Pennsylvania.
Louisville Cement Company, Louisville, Kentucky.
Michigan Portland Cement Company, Chelsea, Michigan.
Thomas Miller Company, Jamesville, New York.
Nazareth Cement Company, Nazareth, Pennsylvania.
New Aetna Portland Cement Company, Detroit, Michigan.
Newaygo Portland Cement Company, Grand Rapids, Michigan.
Northwestern States Portland Cement Company, Mason City, Iowa.
Ogden Portland Cement Company, Ogden, Utah.
Oklahoma Portland Cement Company, Ada, Oklahoma.
Peerless Portland Cement Company, Union City, Michigan.
Peninsular Portland Cement Company, Jackson, Michigan.
Penn-Allen Cement Company, Allentown. Pennsylvania.

Pennsylvania Cement Company, 29 Broadway, New York City, New York.
Phoenix Portland Cement Company, Nazareth, Pennsylvania.
Portland Cement Company of Utah, Salt Lake City, Utah.
Riverside Portland Cement Company, Los Angeles, California.
San Antonio Portland Cement Company, San Antonio, Texas.
Sandusky Portland Cement Company, Sandusky, Ohio.
Security Cement and Lime Company, Baltimore, Maryland.
Southwestern Portland Cement Company, El Paso, Texas.
Standard Portland Cement Company, Charleston, South Carolina.
Standard Portland Cement Corporation, San Francisco, California.
The Superior Portland Cement Company, Cincinnati, Ohio.
Texas Portland Cement Company, Cement, Texas.
Tidewater Portland Cement Company. Baltimore, Maryland.
Trinity Portland Cement Company, Dallas, Texas.
Union Sand and Material Company, International Life Building, St. Louis, Missouri.
United Kansas Portland Cement Company, Iola, Kansas.
United States Portland Cement Company, Denver, Colorado.
Universal Portland Cement Company, 208 South La Salle Street, Chicago, Illinois.
Virginia Portland Cement Company, 26 Beaver Street, New York City, New York.
Vulcanite Portland Cement Company, Land Title Building, Philadelphia, Pennsylvania.
Wabash Portland Cement Company, Ford Building, Detroit, Michigan.
Western States Portland Cement Company, Independence, Kansas.
Whitehall Cement Manufacturing Company, Land Title Building, Philadelphia, Pennsylvania.
Wolverine Portland Cement Company, Coldwater, Michigan.
Wyandotte Portland Cement Company, Wyandotte, Michigan.

Foreign Member

Canada Cement Company, Limited, Montreal, Canada.
St. Mary's Cement, Ltd., Montreal, Canada.

National Paving Brick Manufacturers Association

Officers.—Charles J. Deckman, president, Cleveland, Ohio; J. W. Robb, vice-president, Clinton, Indiana; C. C. Barr, treasurer, Streator, Illinois; Will P. Blair, secretary, Cleveland, Ohio; H. H. MacDonald, assistant secretary, Cleveland, Ohio.

Purposes.—The National Paving Brick Manufacturers Association of this country was organized for the following purposes:

1. A dissemination among its membership of technical knowledge relating to the manufacture of their product.
2. To bring to the attention of the public the merits of Vitrified Brick as a paving material.
3. To influence to the greatest possible extent the proper construction of brick streets.
4. For furnishing truthful and reliable information regarding other paving materials, and their comparative value as pavements when considered with brick pavements.

Paving Brick Manufacturers

Adamantine Clay Products Company, North Mountain, West Virginia.
Albion Vitrified Brick Company, Albion, Illinois.
Allentown Paving Brick Company, Allentown, Pennsylvania.
Alliance Brick Company, Alliance, Ohio.
Alliance Clay Product Company, J. B. Wilcox, Alliance, Ohio.
Alton Brick Company, Eben Rodgers, Alton, Illinois.
American Sewer Pipe Company, A. S. McComb, Akron, Ohio.
Ashtabula Shale Brick Company, N. C. Ralph, Ashtabula, Ohio.
Atchison Paving Brick Company, Atchison, Kansas.
Athens Brick Company, W. N. Alderman, Athens, Ohio.
Banner Clay Works, Edwardsville, Illinois.
Barber Asphalt Paving Company, Des Moines, Iowa.
Barr Clay Company, The, C. C. Barr, Streator, Illinois.
Beer, Paul, Des Moines, Iowa.
Bessemer Limestone Company, C. C. Blair, Youngstown, Ohio.
Big Four Clay Company, G. O. French, Canton, Ohio.
Binghamton Paving Block Company, Binghamton, New York.
Bloomfield Brick Company, Bloomfield, Indiana.
Boone Brick, Tile and Paving Company, W. H. Brecht, Boone, Iowa.
Brick and Stone Company, The A. L. Moredock, Waynesburg, Pennsylvania.
Brick, Terra Cotta and Tile Company, Corning, N. Y.
Buffalo Brick Company, Buffalo, Kansas.
Burke Brothers Brick Company, Fort Smith, Arkansas.
Burton-Townsend Company, The, R. C. Burton, Zanesville, Ohio.
Carlyle Paving Brick Company, G. E. Carlyle, Portsmouth, Ohio.
Carlyle Paving Brick Company, Portsmouth, Ohio.
Clearfield Brick Manufacturing Company, Clearfield, Pennsylvania.
Clearfield Clay Working Company, Clearfield, Pennsylvania.
Cleveland Brick and Clay Company, F. M. Brady, Cleveland, Ohio.
Clinton Paving Brick Company, J. W. Robb, Clinton, Indiana.
Clymer Brick Company, Clymer, Pennsylvania.
Coffeyville Shale Brick Company, Coffeyville, Kansas.
Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kansas.
Copeland-Inglis Shale Brick Company, Birmingham, Alabama.
Corry Brick and Tile Company, D. Warren De Rosay, Corry, Pennsylvania.
Danville Brick Company, W. P. Whitney, Danville, Illinois.
Deckman-Duty Brick Company, C. J. Deckman, S. M. Duty, Cleveland, Ohio.
Denny-Renton Clay and Coal Company, Seattle, Washington.
Detroit Vitrified Brick Company, Detroit, Michigan.
Du Bois-Butler Brick Company, Du Bois, Pennsylvania.
Flint Brick and Coal Company, Des Moines, Iowa.
Foster Sales Company, Bradford, Pennsylvania.
Freeport Clay Products Company, Freeport, Pennsylvania.
Fultonham Brick Company, East Fultonham, Ohio.
Georgia Vitrified Brick and Clay Company, Augusta, Georgia.
Glen-Gery Brick and Cement Company, Reading, Pennsylvania.
Gloninger and Maxwell, Pittsburgh, Pennsylvania.
Graves Shale Paving Brick Company, Birmingham, Alabama.
Hammond Fire Brick Company, T. I. Brett, Fairmont, West Virginia.
Hankinson and Hagler, Augusta, Georgia.
Harris Brick Company, Cincinnati, Ohio.
Hocking Valley Brick Company, L. J. Murphy, Nelsonville, Ohio.
Hydraulic Pressed Brick Company, St. Louis, Missouri.

Independence Brick Company, Independence, Kansas.
Indiana Paving Brick and Block Company, Indianapolis, Indiana.
Jamestown Paving Brick Company, Jamestown, New York.
Kelly Brick Company, Wm. P. Winder, Pennsylvania.
Kline Brick Company, John, Wickliffe, Ohio.
Kushequa Brick Company, E. K. Kane, Kushequa, Pennsylvania.
Layton Fire Clay Company, McKeesport, Pennsylvania.
Lincoln Paving Block Company, G. O. French, Canton, Ohio.
Los Angeles Pressed Brick Company, Los Angeles, California.
Mack Manufacturing Company, Philadelphia, Pennsylvania.
Marion Brick Works, Montezuma, Indiana.
Martinsville Brick Company, Martinsville, Indiana.
Massillon Brick Company, Massillon, Ohio.
Mayer Brick Company, C. P., Bridgeville, Pennsylvania.
McAvoy Vitrified Brick Company, 1345 Arch Street, Philadelphia, Pennsylvania.
Medora Shale Brick Company, C. C. McMillan, Medora, Indiana.
Metropolitan Paving Brick Company, J. G. Barbour, Canton, Ohio.
Michigan Vitrified Brick Company, Bay City, Michigan.
Murphysboro Paving Brick Company, E. St. Louis, Illinois.
Nelsonville Brick Company, C. H. Doan, Nelsonville, Ohio.
Newburgh Brick and Clay Company, J. R. Zmunt, Cleveland, Ohio.
New Era Vitrified Brick Company, Bay City, Michigan.
New Hope Vitrified Brick Company, New Hope, Pennsylvania.
Noble Brick Company, Glenwood, Ohio.
Novelty Brick and Coal Company, Newcomerstown, Ohio.
Oakland Paving Brick Company, Decota, California.
Patten Clay Company, Patten, Pennsylvania.
Patterson Clay Products Company, Clearfield, Pennsylvania.
Pennsylvania Clay Company, Pittsburgh, Pennsylvania.
Peebles Paving Brick Company, F. L. Manning, Portsmouth, Ohio.
Pittsburgh Vitrified Paving and Building Brick Company, Kansas City, Missouri.
Poston, C. E., Attica, Indiana.
Poston Paving Brick Company, J. M. Waugh, Crawfordsville, Indiana.
Portsmouth Granite Brick Company, Firebrick, Kentucky.
Puritan Brick Company, Hamden, Ohio.
Purington Paving Brick Company, Galesburg, Illinois.
Reynoldsville Brick and Tile Company, Reynoldsville, Pennsylvania.
Saginaw Paving Brick Company, Saginaw, Michigan.
Scioto Fire Brick Company, C. W. Turner, Sciotoville, Ohio.
Sharon Clay Products Company, W. C. Taylor, Sharon, Pennsylvania.
Shawmut Paving Brick Company, Alfred Yates, Shawmut, Pennsylvania.
Smith, Company, A. F., P. A. Smith, New Brighton, Pennsylvania.
Soisson, Fire Brick Company, Jos., Bolivar, Pennsylvania.
South Zanesville Sewer Pipe and Brick Company, J. C. Bolen, Jr., Zanesville, Ohio.
Southern Clay Manufacturing Company, Chattanooga, Tennessee.
Southern Fire Brick and Clay Company, Montezuma, Indiana.
South Webster Brick and Tile Company, South Webster, Ohio.
Springfield Paving Brick Company, Springfield, Illinois.
Standard Brick Company, Crawfordsville, Indiana.
Standard Clay Company, Tacoma, Washington.
Standard Shale Company, Youngsville, Pennsylvania.
Standard Vitrified Brick Company, Coffeyville, Kansas.
Sterling Brick Company, Olean, New York.

Stipp, Peter, successor to Scranton Vitrified Brick Company, Scranton, Pennsylvania.
Streator Paving Brick Company, E. F. Plumb, Streator, Illinois.
Suburban Brick Company, Moundsville, West Virginia.
Terre Haute Vitrified Brick Company, J. M. Hoskins, Terre Haute, Indiana.
Thorton Fire Brick Company, D. R. Potter, Clarksburg, West Virginia.
Thurber Brick Company, Thurber, Texas.
Tidewater Paving Brick Company, Catskill, New York.
Toronto Fire Clay Company, Toronto, Ohio.
Trimble Brick Manufacturing Company, J. H. Simpson, Dayton, Ohio.
Tulsa Brick Company, Tulsa, Oklahoma.
Tuna Valley Pressed Brick Company, Bradford, Pennsylvania.
United Brick Company, G. H. Francis, Greensburg, Pennsylvania.
United Fire Brick Company, Uniontown, Pennsylvania.
Vinton Brick Company, Dayton, Ohio.
Vulcan Brick Company, Wellsville, Ohio.
Wabash Clay Company, Veedersburg, Indiana.
Watsontown Brick and Clay Products Company, Watsontown, Pennsylvania.
Western Clay Manufacturing Company, C. H. Bray, Helena, Montana.
Westport Paving Brick Company, John W. Hall, Baltimore, Maryland.
Windsor Brick Company, J. T. Windsor, Akron, Ohio.
Windsor Brick and Tile Company, Sedalia, Missouri.
Wooster Shale Brick Company, W. R. Barnhardt, Jr., Wooster, Ohio.
Youngsville Brick and Tile Company, Bradford, Pennsylvania.

Wood Block Paving Manufacturers

American Creosoting Company, Marion, Illinois.
American Creosoting Company, Louisville, Kentucky.
American Creosoting Company, Newark, New Jersey.
American Creosoting Company, 17 Battery Place, New York City.
American Creosote Works, New Orleans, Louisiana.
Ayer and Lord Tie Company, Argenta, Arkansas.
Ayer and Lord Tie Company, Carbondale, Illinois.
Ayer and Lord Tie Company, Grenada, Mississippi.
Barber Asphalt Paving Company, Maurer, New Jersey.
Canada Creosoting Company, Louisville, Kentucky.
Chicago, Burlington and Quincy Railroad, Galesburg, Illinois.
Chicago Creosoting Company, Chicago, Illinois.
Colman Creosoting Company, Seattle, Washington.
Columbia Creosoting Company, Portland, Oregon.
Compressed Wood Preserving Company, The, Cincinnati, Ohio.
Creosoted Wood Block Paving Company, New Orleans, Louisiana.
Eppinger and Russell Company, Long Island City, New York.
Great Northern Railway Company, St. Paul, Minnesota.
Gulfport Creosoting Company, Gulfport, Mississippi.
Indiana Creosoting Company, Louisville, Kentucky.
International Creosote and Construction Company, Beaumont, Texas.
International Creosote and Construction Company, Texarkana, Texas.
Jennison Wright Company, Toledo, Ohio.
Kettle River Company, The, Madison, Illinois.
Kettle River Company, The, Sandstone, Minn.
Louisville and Nashville Railroad Company, Louisville, Kentucky.
Michigan Wood Preserving Company, Pittsburgh, Pennsylvania.
National Lumber and Creosoting Company, Texarkana, Arkansas.
New Orleans Wood Preserving Company, New Orleans, Louisiana.
Northern Pacific Railway, St. Paul, Minnesota.

Oregon-Washington Railroad and Navigation Company, Portland, Oregon.
Pacific Creosoting Company, Eagle Harbor, Washington.
Pennsylvania Railroad, Philadelphia, Pennsylvania.
Pioneer Lumber and Creosoting Company, Ensley, Alabama.
Pittsburgh Wood Preserving Company, Pittsburgh, Pennsylvania.
Puget Sound Wood Preserving Company, Lowell, Washington.
Republic Creosoting Company, Mobile, Alabama.
Republic Creosoting Company, Indianapolis, Indiana.
Republic Creosoting Company, Minneapolis, Minnesota.
St. Paul and Tacoma Lumber Company, Tacoma, Washington.
Shreveport Creosoting Company, Shreveport, Louisiana.
Southern Creosote Company, Ltd., Slidell, Louisiana.
Southern Pacific Railway, San Francisco, California.
Southern Paving Construction Company, Chattanooga, Tennessee.
Southern Wood Preserving Company, Atlanta, Georgia.
U. S. Wood Preserving Company, Norfolk, Virginia.
Wyckoff Pipe Creosoting Company, Portsmouth, Virginia.

American Concrete Institute

BOARD OF DIRECTION

Officers.—Leonard C. Wason, President Aberthaw Construction Company, 8 Beacon Street, Boston, Massachusetts, president; William K. Hatt, Professor of Civil Engineering, Purdue University, Lafayette, Indiana, vice-president: Henry C. Turner, President Turner Construction Company, 11 Broadway, New York City, vice-president; Robert W. Lesley, Pennsylvania Building, Philadelphia, Pennsylvania, treasurer; C. L. Fish, 1418 Walnut Street, Philadelphia, Pennsylvania, secretary; Richard L. Humphrey, Consulting Engineer, Harrison Building, Philadelphia, Pennsylvania, past president.

Directors.—First District, William H. Ham, Consulting Engineer, 88 Pearl Street, Boston, Massachusetts; Second District, Edward D. Boyer, Expert, Atlas Portland Cement Company, 30 Broad Street, New York City; Third District, Ernest Ashton, Chemical Engineer, Lehigh Portland Cement Company, Allentown, Pennsylvania; Fourth District, William P. Anderson, President Ferro-Concrete Construction Company, Richmond and Harriet Streets, Cincinnati, Ohio; Fifth District, Alfred E. Lindau, Manager, Western Division, Corrugated Bar Company, 20 West Jackson Street, Chicago, Illinois; Sixth District, John B. Leonard, Civil Engineer, 526 Rialto Building, San Francisco, California.

National Lime Manufacturers Association

Officers.—William E. Carson, president, Riverton, Virginia; Martin Deeley, first vice-president, Lee, Massachusetts; J. F. Pollock, second vice-president, Kansas City, Missouri; Bernard L. McNulty, third vice-president, Anniston, Alabama; Fred K.

Irvine, secretary, Chicago, Illinois; C. W. S. Cobb, treasurer, St. Louis, Missouri.

Executive Committee.—W. E. Carson, chairman, ex-officio; Charles Warner, Wilmington, Delaware; Lawrence Hitchcock, Cleveland, Ohio; H. S. Gray, Louisville, Kentucky.

National Association of Sand and Gravel Producers

Officers.—F. W. Renwick, Chicago Gravel Company, 343 S. Dearborn Street, Chicago, Illinois, president; H. H. Halliday, Halliday Sand Company, Cairo, Illinois, first vice-president; W. F. Bradley, Ohio and Michigan Sand and Gravel Company, Toledo, Ohio, second vice-president; H. F. Curtis, Lyman Sand Company, Omaha, Nebraska, third vice-president; Lee R. Witty, Wabash Sand and Gravel Company, Terre Haute, Indiana, fourth vice-president; C. H. Brand, Atwood-Davis Sand Company, Chicago, Illinois, treasurer.

AMERICAN HIGHWAY ASSOCIATION

The American Highway Association was organized at Washington, D. C., November 22, 1910.

Its purposes are:

To correlate and harmonize the efforts of all existing organizations working for road improvement.

To arouse and stimulate sentiment for road improvement.

To strive for wise, equitable and uniform road legislation in every State.

To aid in bringing about efficient road administration in the States and their subdivisions, involving the introduction of skilled supervision and the elimination of politics from the management of the public roads.

To seek continuous and systematic maintenance of all roads, the classification of all roads according to traffic requirements, payment of road taxes in cash, and adoption of the principle of State aid and State supervision.

To advocate the correlation of all road construction so that the important roads of each county shall connect with those of the adjoining counties and the important roads of each State shall connect with those of adjoining States.

To strive for the utilization of convict labor on works of public improvement, where that course is consistent with the local policy, so as to involve the least possible competition with free labor, the utmost public benefit, and a healthy moral and physical development of the convict. In many States these results can be attained by using the convicts on road work or the preparation of road materials.

Constitution

ARTICLE I

(as amended)

Name

SECTION 1. The name of this organization shall be THE AMERICAN HIGHWAY ASSOCIATION.

ARTICLE II

Object

SECTION 1. The object of this Association is to harmonize and correlate all efforts for the improvement of the public roads, to the end that adequate and efficient systems of road construction, administration, and maintenance may be adopted in all of the States.

ARTICLE III

Location

SECTION 1. The official headquarters of this Association shall be located and maintained in the city of Washington, D. C.

ARTICLE IV

Membership

SECTION 1. The regular membership of this Association shall be composed of all persons who shall sign the roll of membership at the time of organization, or make written application to the Secretary and pay annual dues for one year in advance, membership to begin with written acceptance by the Secretary.

SEC. 2. The associate membership shall consist of all members of State and other organizations for road improvement, coöperating with this Association, *provided*, that a roster of such membership shall be filed with the Secretary by said organization.

SEC. 3. The sustaining membership shall consist of all persons or organizations who shall sign the roll of sustaining membership at the organization of this Association, or make written application to the Secretary and pay annual dues for sustaining membership one year in advance, membership to begin as soon as written acceptance shall have been received from the Secretary.

ARTICLE V (as amended)

Officers

SECTION 1. The officers of this Association shall consist of a President, a Vice-President, a Treasurer, and a Board of Directors, consisting of the President and Vice-President of the Association and twenty-three additional members, to be elected at the annual meeting of the Association as hereinafter provided, and such other executive officers as may be appointed by the Executive Committee.

SEC. 2. The President, Vice-President, Treasurer, and members of the Board of Directors shall be regular or sustaining members of the Association, and shall be elected at the first regular meeting and annually thereafter, except that the members of the Board, exclusive of the officers, shall be elected in three groups, the first to hold office for a period of three years, the second to hold office for a period of two years, and the third to hold office for a period of one year, vacancies on the Board to be filled annually thereafter.

ARTICLE VI

Committees

SECTION 1. There shall be four standing committees of this Association: An Executive Committee, consisting of five members; a Finance Committee; a Committee on Membership, and an Auditing Committee, consisting of three members. The members of the Auditing Committee shall be selected by the President at the first annual meeting, and shall hold office until the next regular meeting of the Association. The members of the other three committees shall be selected by the Board of Directors, and shall hold office until the next regular meeting of the Association.

ARTICLE VII

Amendments

SECTION 1. This Constitution may be amended at any regular meeting of the Association by three-fourths of the qualified voters present, *provided*, that the Secretary shall notify members of the Association of said regular meeting.

ARTICLE VIII

By-Laws

SECTION 1. The Board of Directors shall make such By-Laws for the government of the Association as it may deem necessary, and which shall not conflict with the provisions of the Constitution, and may amend or alter the same.

By-Laws

ARTICLE I

Annual Dues

SECTION 1. The annual dues for regular members of the Association shall be $5, payable in advance. Annual dues for sustaining members shall be $100, payable in advance. Associate members shall not be required to pay annual dues to this Association.

ARTICLE II

Voting Privileges

SECTION 1. Regular members of the Association shall be entitled to participate in its proceedings, and vote upon all questions that may come before the Association. Associate members shall be entitled to participate in discussions of questions before the Association. Sustaining members shall be entitled to participate in discussions, and to vote upon questions before the Association.

ARTICLE III

Duties of Officers

SECTION 1. The President shall be the executive head of the Association He shall preside at all meetings of the Association, and shall appoint an Auditing Committee and all temporary committees.

SEC. 2. In the absence of the President the Vice-President shall act in his place and stead, *provided*, that in the absence of both the President and Vice-President the Executive Committee shall immediately elect one of its members to perform the duties of the President.

SEC. 3. The Secretary shall keep the records and minutes of the Association. He shall draw all orders upon the Treasurer for the payment of money. He shall serve all notices and perform all duties necessary to the proper conduct of the business affairs of the Association, and shall perform such additional duties as may be assigned to him by the Board of Directors. He shall make written report annually of the work of the Association, and shall make such special written reports to the Board of Directors as they may require from time to time.

SEC. 4. The Treasurer shall be the custodian of the funds of the Association. He shall pay all orders for money duly signed by the Secretary. He shall make a written report annually to the Association, accounting for all funds received and disbursed. If the Treasurer shall for good and sufficient reason be temporarily unable at any time to perform the duties of his office, he shall so inform the chairman of the Executive Committee, who shall, with the concurrence of two other members of said committee, designate one of their members to perform the duties of Treasurer, until such time as the Treasurer shall resume his duties and so inform the chairman of the Executive Committee.

SEC. 5. The Organizer shall perform such duties as are assigned to him by the Board of Directors.

SEC. 6. The Board of Directors shall at its first meeting and annually thereafter elect a chairman. The Board shall have custody of all property of the Association; shall have charge of the financial affairs of the Association; shall provide ways and means for its expenses, shall appoint all regular committees and all officers not otherwise provided for, shall have supervision and control over all work carried on by the Association and its officers, and shall fill all vacancies in its own membership and among the officers of the Association between the meetings of the Association.

ARTICLE IV

Duties of Committees

SECTION 1. The Executive Committee shall act for the Board of Directors and exercise all the powers of said Board in the interim between the meetings of said Board, and shall report quarterly to the Board the condition of the Association and its work.

SEC. 2. The Committee on Finance shall provide for the raising of funds to carry on the work of the Association and shall have supervision over the financial affairs of the Association.

SEC. 3. The Committee on Membership shall deal with all questions relating to membership in the Association, and shall take such steps as it may deem advisable for increasing the membership of the Association.

SEC. 4. The Auditing Committee shall audit and review the reports of the Secretary and the Treasurer.

ARTICLE V

Meetings

SECTION 1. Regular meetings of the Association shall be held annually at such time and place as the Board of Directors may determine. Special meetings may be called by the Board of Directors, or by two-thirds of the regular members of the Association.

SEC. 2. The Board of Directors may fix the time and place of its meetings, provided that it shall meet at least once in each year.

SEC. 3. The Executive Committee shall fix the time and place of its meetings, provided that it shall meet at least once in each three months.

ARTICLE VI

Quorums

SECTION 1. A quorum of the Association shall consist of fifty members who shall be present in person.

SEC. 2. A quorum of the Board of Directors shall consist of five members who shall be present in person.

SEC. 3. A quorum of the Executive Committee shall consist of a majority of its members.

ARTICLE VII

Amendments

SECTION. 1. The By-Laws of this Association may be altered or amended by the Board of Directors, at their discretion, *provided,* that such By-Laws shall not conflict with the provisions of the Constitution.

Working Plan

In addition to its volunteer non-paid workers, the Association has a small corps of thoroughly competent salaried men whose duties are: to appear before State legislative committees, on invitation, and give advice on pending road legislation; to address conventions and local meetings in advocacy of needed reforms in road improvement; to organize and prepare working plans for local road improvement associations; to prepare articles of educational and news value for the use of the press in arousing, stimulating and directing public sentiment.

The Association is continually assembling data concerning the progress and status of the road movement, embracing road legislation, bond issues, mileage and cost of roads, organization work, etc.

Annually the Association holds a Road Congress for the discussion of problems of road construction, maintenance and administration, and for correlation and coördination of the work conducted by the various State and Interstate road organizations.

The Association coöperates with railroad companies and the national government in educational campaigns through the medium of "Good Roads Trains." Under this plan the government provides a miniature working exhibit illustrating types of roads and methods of construction, a stereopticon with slides, and assigns one or more demonstrators to accompany the train at government expense for salary, travel and subsistence. The Association at its own expense provides an experienced organizer who organizes in each county traversed, a practical association and suggests a constitution and a working plan for it. The plan in general is as follows:

It is suggested that as soon as the organization has been completed, a constitution and by-laws adopted and permanent officers elected, working committees should be selected whose distribution of duties and responsibilities should be somewhat as follows:

(a) *Committee on Road Administration.*—This committee should ascertain the laws upon which the road administration of the county or locality are based, the personnel of the official organization selected to carry out such laws, the revenues available for road purposes, how obtained, how expended, and what system of accounting and recording is followed. It should recommend needed reforms in road laws, organization and administration; it should ascertain the various sources of revenue and plans for raising additional revenues; and should eventually formulate its findings into a report containing recommendations for the future financing of road work.

(b) *Committee on Road Materials.*—This committee should ascertain the location, character, quantity and availability of all road materials in the county. This work can be much facilitated by coöperation with the Office of Public Roads of the United States Department of Agriculture, which makes analyses and tests of road materials free of charge, whereby the kind and quality of road building material can be definitely ascertained. The committee should also make a study of transportation facilities for road materials, and work out plans whereby the county or locality can obtain the best materials in the easiest and most economical manner. They might consider the advisability of the purchase of quarries and gravel pits, the arrangement of special rates with the railroad companies, the preparation of the materials by county prisoners, etc.

(c) *Committee on Road Construction and Maintenance.*—This committee should ascertain the mileage of public roads, and classify them according to amount and importance of traffic, ascertaining the improvement that is necessary and the probable cost; draw up a general plan for the gradual improvement of all the county roads along definite, intelligent lines, according to the means available; obtain data bearing upon all phases of road construction; and should coöperate closely with the committee on road materials in drawing up its recommendations as to the kind and amount of road construction to be undertaken. It should make a close study of road maintenance, with a view to introducing the best and most economical methods for maintaining the roads. It should look into the relative merits of the various kinds of road equipment, and aid the county authorities by information and advice in securing the necessary equipment.

(d) *Committee on Earth Roads.*—This committee should devise ways and means for stimulating interest in the road drag, and should endeavor to bring about the general use of this simple little implement. Records could be kept of the number of drags in use, and the mileage of roads regularly dragged as the result of the work of the committee. Contests could be inaugurated and publicity given the work, so that the interest might become widespread, and practical results accomplished.

The Association plans to issue instructive publications from time to time, in addition to the Year Book, including the papers read and proceedings had at the Annual Road Congress.

The foregoing specific examples indicate *in part* the *methods* by which the Association is endeavoring to carry out its purposes. New methods and new lines of activity frequently develop and are utilised as far as practicable.

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Hvass & Company, Chas.
Hyde, Thomas

Ice, William B.
Ideal Crushed Stone Company
Ingram, Geo. M.
Inland Steel Company
Irby, W. O.
Ironton Portland Cement Co.
Irvine, W. B.

Jackson, Malcolm
Jackson, R. B.
Jacobs, Henry G.
Jacobus, Worthington M.
Jaeger Machine Company
Jahnke, Walter C.
Jaicks Company, A.
Jaques, Herbert
Jaques, H. P.
Jefferson Powder Company
Jeffress, Thos. F.
Jenks, George J.
Jenkins, J. B.
Jennings, Miss A. B.
Jennings, Hennen
Jennison, H. G.
Jeppers, Thos. F.
Jewett, W. O.
Johnson, A. N.
Johnson, A. S.
Johnson, Charles J.
Johnson, F. O.
Johnson, John D.
Johnson, John H.
Johnson, L. E.
Johnson, M. B.
Johnston, John A.
Jones, Edwin P.
Jones, Fred
Jones, Isaac B.
Jones, Jas. Ellwood
Jones, O. F.
Joseph, Chester V.
Joyner, F. H.
Judson, O. H.

Kansas City Public Library
Kauffman, O. F.

Kaull, P. S.
Keene, Foxhall P.
Keith, Sidney W.
Keller, Herbert P.
Keller, W. S.
Kelley, Fred W.
Kelley, Wm. V.
Kelsey, Clarence H.
Kelsey, E. H.
Kemp, L. W.
Kendall, Amos
Kendall, Chas. H.
Kendrick, Arthur
Kennedy, Dennis A.
Kennon, Lyman W. V.
Kenyon, Clarence A.
Kerr, Charles M.
Kersey, Harvey
Kershaw, Wm. H.
Keyes, John M.
Kidd, Robert F.
Kilbourn, C. W.
Kilbury, J. S.
Kilmer, George L.
Kimball, A. R.
Kinch, D. C.
King, H. V. D.
King, James P.
King, Rupert C.
King, Mrs. Rupert C.
King, Thos. B.
King, Wilbur F.
Kingsley, E. A.
Kinney, Wm. M.
Kirkland, John L.
Kissel Kar Company
Kittle, Warren
Knapp, Martin A.
Knickerbocker Portland Cement Company
Knight, A. R.
Knight, C. D.
Knight, E. W.
Knoch, J. J.
Koehring Machine Company
Koen, E. B.
Koen, J. T.
Koiner, George W.
Kontz, Ernest C.
Kramer, Xavier A.
Kriegshaber & Son, V. H.
Krumbhols, T. Edmund

Laing, A. T.
Laing, Edward M.
Laird, H. C.
Lake Shore Stone Company
Lamb, E. T.
Lambert, H. L.
Landenberger, J. M.
Landers, George M.
Landon, Alvin W.
Lane, J. E.
Lane, J. R.
Lane, P. E.
Langan, H. B.
Langevin, Aimes
Lapham, Lewis H.
Larcombe, John S.
Larkin, John D.
Lassiter, B. H.
Laughlin, George A.
Laughlin, James, 3d
Law, W. E.
Lawson, Victor F.
Lawton, A. J.
Layne, Ernest
Layton, Hudson F.
Lazear, J. S.
Leahy, W. J.
Learned, Walter
Lee, Arthur
Lee, Blair
Lee, Jesse B.
Lee, W. I.
Legare, Alexander B.
Leigh, Egbert G., Jr.
Lemon, Walter B.
Leonard, John C.
Leplastrier, Arthur
Lesley, Robert W.
Leslie, M. G.
Lesner, John A.
Letton, J. F.
Levinson, H.
Lewis, Arthur S.
Lewis, C. Cameron, Jr.
Lewis, W. H.
Light, Charles P.
Lilley, George M.
Lincoln, A. T.
Lincoln, S. Dana
Lindsay, Gordon I.
Lindsey, R. L.
Linnell, F. J.
Linsley, Chas. W.
Lippincott, James J.
Lits, G. W.
Lloyd, Horatio G.
Lober, John B.
Lockwood, Ernest D.
Logan, James
Lombard, P. H.
Long, J. H.

Long, Joe L.
Longfellow, Miss Alice M.
Longville Lumber Company
Loring, D. A.
Los Angeles Chamber of Commerce
Louis, John C.
Lowe, Col. J. M.
Lowe, P. E.
Lowery, T. A.
Lowndes, Richard T.
Lucas, C. F.
Lufkin, E. C.
Lufkin Rule Company
Luke, David L.
Luten, A. B.
Luten, Daniel B.
Luts, George W.
Lynch, J. W.
Lynch, M. J.
Lyon, Charles L.
Lyon, E. B.
Lyon, Frank D.
Lyon, Geo. L.
Lyon, J. P.

McAndrew, Aeneas
McAvoy, John C.
McCamic, Charles
McCarthy, William
McCaustland, E. J.
McCay, H. K.
McClaren, W. J.
McClellan, A. P.
McClintock, J. Y.
McCluer, Wm. B.
McClure, Fay
McCombs, A. S.
McCombs, C. E.
McConaughey, William C.
McConnell, E. B.
McConnell, L. G.
McCool, D.
McCord, Alvin C.
McCormick, E. B.
McCormick, Harold F.
McCormick, Vance C.
McCrary, J. B. Company
McCrea, W. S.
McDaniel, J. U. C.
McElroy, James A.
McLeroy, Jos. L.
McGarry & Company, John A.
McGlynn, Hugh A.
McGovern, T. J.
McGrath, George B.
McGraw, James H.
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McGuire, F. J.
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McGuire, Dr. Stuart
McIlvaine, Wm. D.
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McKinley, J. C.
McKinley, William B.
McKinstry, K. T.
McLaughlin, Harry A.
McLean, W. A.
McLure, B. S.
McMillan, Mrs. James
McMillan, Philip H.
McMorris, D. W.
McMullen, Clements
McNamee, George A.
McNeil, Donald
McNerney Construction Company
McPherson, A. J.
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McQueen, J. R.
McVettie, R. R.
MacAlester, Charles
MacArthur, John R.
MacCorkle, Wm. A.
MacDonald, H. H.
MacDonald, James H.
MacKendrick, W. G.
MacLean, R. J.
Mackall, W. W.
Maddox, J. W.
Maddox, Samuel
Magid, Louis B.
Magrath, C. A.
Mahoney, M. V.
Mann, Edwin
Mann, Isaac T.
Manning, Frank J.
Manning, J. R.
Manning, Warren H.
Manufacturers' Record Publishing Company
Marble, Mrs. Frank
Marden, Robert F.
Marion Steam Shovel Company
Marker, James R.
Markham, George D.
Marsteller, J. H.
Martin, Col. A. D.
Martin, A. G.
Martin, Mrs. Eleanor
Martin, E. W.
Mason, George G.
Mason, James B.
Massengale, St. Elmo
Massey, L. C.
Masters, W. M.

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Mathewson, E. P.
Mathews, William B.
Matthews, Wm. R.
Matthieson, George
Maxwell, Haymond
Maxwell, Lee
Maxwell, W. Brent
Mayer, C. P.
Mayo, P. H.
Meador, T. D., Jr.
Meals, S. W.
Means, A. E. N.
Megahee, Grover
Mehren, E. J.
Meridian Road Association
Merillat, P. C.
Merydith, E. A.
Meserve, H. Fessenden
Meservie, W. R.
Metcalf, Morris
Metzger, William E.
Meyer, Edwin O.
Michaud, B.
Michigan Portland Cement Co.
Miller, A. C.
Miller, Edward
Miller, F. E.
Miller, Guy D.
Miller, G. H.
Miller, John A.
Miller, M. H.
Miller, R. T.
Miller Walton
Miller Engineering & Construction Company
Mills, Morgan R.
Mills, Oscar
Miner, H. A.
Miner, Joshua L.
Mingea, W. E.
Minker, H. M.
Mitchell, Samuel
Mitchell, W. K.
Mize, R. D.
Moat, O. J.
Mockler, C. N.
Mohun, Barry
Monfort, G. F.
Montana Good Roads Congress
Moody, George T.
Moon, Charles H.
Moore, Clinton H.
Moore, Everett L.
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Moore, J. Hampton
Moore, J. M.
Moore, R. Walton
Moore, Col. S. A.
Moore, W. P.
Moors, E. J.
Moot, Adelbert
Morehead, J. L.
Morford, Denton
Morfort, G. F.
Morgan, E. R.
Morgan. S. T.
Morley, C. R.
Morrill, C. W.
Morris, Tusca
Morrison, Edwin J.
Morrison, D. J.
Mosely, F. S.
Mott, Charles S.
Moyer, Albert
Mudd, Dr. H. G.
Mueller, John W.
Mullis, Ira B.
Murphy, Edward
Murphy, J. E.
Murphy, Thos. D.
Murray, Oscar G.
Myers, F. P.
Myers, Lilburn T.

Nagle, G. O.
National Building Supply Co.
Naylor, R. B.
Nazareth Cement Company
Neal, E. B.
Neal, W. A., Sr.
Neely, Harry J.
Nelson, Lyman H.
Nelsonville Brick Company
Neuman, James V.
Neustadt, R. M.
New Aetna Portland Cement Co.
Newcomb, Howard R.
Newcomb, S. J.
Newcomb, Wm. T.
New York Public Library
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Nicholson, John P.
Noah, A. H.
Norman, Guy
Norris, T. G.
North Carolina Good Roads Assn.
Northcott, G. A.
Northrop, Claudian B.
Nostrand, Peter E.
Nyman, Howard S.

Ochs, Adolph S.
Ogden Portland Cement Co.

Oglebay, Crispin
Ohley, Wm. A.
Oklahoma Portland Cement Co.
Olcott, Dudley
Oliver, J. A.
Olsen, Testing Machine Co., Tinius
O'Neil, J. Denny
Orenstein-Arthur Koppel Co.
Osborne, William
Osenton, Charles W.
Osgood, C. F.
Osgood, M.
Owen, James
Owen, Robert L.
Owen, R. M.

Page, Legh R.
Page, Logan Waller
Page, Louis R.
Page, S. Davis
Palmatory, J. T.
Palmer, H. R.
Palmer, Mrs. Potter
Pannill, Wm. R.
Park Automobile Company
Parker, A. D.
Parker, Harold
Parker, Robert H.
Parkhurst, J. Reed
Parsons-Souders Company, The
Passano, Edward B.
Patterson, John H.
Patterson, John L.
Patterson, M. C.
Pattie, W. H.
Patton Clay Manufacturing Co.
Paull, A. W.
Paxon, Frederic J.
Pearce, W. G.
Pearson, R. P.
Peerless Portland Cement Co.
Pemberton, Robert L.
Pence, A. P.
Penfield, L. W.
Penfield, R. C.
Peninsular Portland Cement Co.
Penland, John R.
Pennybacker, I. S.
Pennybacker, J. E.
Pennsylvania State Library
Peoples Trust Company
Peques, B. W.
Perkins, Chas. E.
Perkins, George H.
Perkins, Hamilton
Perkins, Seth, Jr.
Perkins, Wm. C.
Peters, C. C.
Peters, W. F.
Peterson, B. W.
Pettibone, Mulliken & Company
Pfeiffer, Jacob
Philadelphia Quartz Company
Philip, J. Van Ness
Philips, S. Jones
Phillips, Charles R.
Phillips, John F.
Phillips, J. W.
Phillips, W. S.
Philpot, C. M.
Phoenix Portland Cement Co.
Piedmont Hotel
Pierce, Daniel T.
Pierrepont, Seth L.
Pillsbury, Franklin C.
Pindell, William M.
Pleak, W. R.
Pochelon, Albert
Poffenberger, George
Polk, Dr. W. M.
Pollard Brothers
Pollard & Bagby
Pollard, John M.
Pollock, C. D.
Poole, J. L.
Poole, John
Portage Silica Company, The
Porter, Alexander J.
Portland Cement Company of Utah
Porter, John
Post, Ira C.
Potter, Dell M.
Potter, D. R.
Potter, Mark W.
Potter, N. S.
Potts, Prof. Robt. J.
Potts, W. B.
Powell, Charles
Powell, P. W.
Powers, E. L.
Pratt, Joseph Hyde
Prescott, E. J.
Price, Andrew
Price, Charles P.
Price, Oscar A.
Prichard, H. W.
Priest, H. W.
Pringle, L. J.
Pritchard, L.
Proctor, R. T.
Puffer, S. P.
Pugh & Hubbard Company
Pulitzer, Ralph
Pullar, Harold B.

Purdue University Library
Putnam, A. H.

Quarles, Edwin L.
Quincy, C. F.

Rabbeitt, C. T.
Rablin, John R.
Rader, B. H.
Railsback, W. S.
Rainbow Route Through Colorado
Ramsey, Andrew
Ramsey, W. H.
Ramspeck, R. C. W.
Randolph, E. F.
Rankin, A. M.
Randall, Theodore A.
Randolph & Company, Isham
Ransome, Ernest L.
Rapallo, C. A.
Rathman, Otto
Raymond, A. G.
Rayner, H. S.
Reay, David C.
Redfield, Charles H.
Redwood, John
Reefer, L. N.
Reel, C. Gordon
Reid, Alexander
Reimer, Frederic A.
Remington, Franklin
Renkert, H. S.
Reno, S. J.
Repair, John F.
Rice, L. M.
Richards, H. DeC.
Richards, J. Donald
Richardson, B. F.
Richardson, Clifford
Richardson, J. F.
Riegel, John I.
Riggs, E. Francis
Rinehart, Lloyd
Rinehart, W. A.
Ripley, Theron M.
Ritter, Charles F.
Ritter, C. Lloyd
Ritz, Harold A.
Roach, J. B.
Robbins, Francis L., Jr.
Roberts, Thomas
Roberts, W. J.
Robeson, J. S.
Robinson, Cecil A.
Robinson & Ross
Rock Products
Rodgers, P. B.
Rohn, Oscar
Roosevelt, R. B.
Rossell, Wm. T.
Rourke, L. K.
Rowland, L. M.
Roy, Sebastian
Roy, William R.
Rumsey, Mrs. Dexter P.
Runnells, J. S.
Russell, Frank
Russell Grader Manufacturing Co.
Ruth, J. W.
Rutter, Mrs. David

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Sampsell, P. D.
Sands, Daniel C., Jr.
Sands, Lawrence E.
Sanders, Herbert W.
Sanders, Jos. M.
Sargent, Wm. D.
Sayres, A. L.
Scales, George C.
Scates, John C.
Schaub, J. G.
Scholle, Gustave
School of Civil Engineering
Schutte, August E.
Scott, Fred W.
Scott, George C.
Scott, Nathan B.
Scott, R. P.
Screeton, E. R.
Sebold, R. P.
See, George C.
Seely, Ray
Seested, H.
Seitz, D. W.
Selsmeyer, J.
Sevier, L.
Shannon, E. W.
Shannon, W. T.
Shapleigh, A. L.
Sharkey, James L.
Sharples, Philip P.
Shattuck, A. R.
Sheldon, Edwin B.
Shephard, Finley J.
Shepherd, John A.
Shepley, Ether L.
Shidler, J. R.
Shirley, Henry G.
Shorey, H. S.
Short, Clarence A.
Simard, George A.

Simmons, George W.
Simms, John T.
Simpson, S. C.
Sinclair, D. J.
Sinnickson, George R.
Sisson, W. G.
Skelton, Gordon V.
Slack, S. B.
Slemp, C. Bascom
Slick Brothers Construction Co.
Smith, A. Alexander
Smith, A. Crawford, Jr.
Smith, Blaine
Smith, B. M.
Smith, C. H.
Smith, Charles H.
Smith, Fred F.
Smith, H. F.
Smith, James E.
Smith, John E.
Smith, J. N.
Smith, J. R.
Smith, L. C.
Smith, L. F.
Smith, R. A. C.
Smith, T. L., Company
Smith, S. Preston
Smith, Victor C.
Smith, W. D.
Smith, W. L.
Smith, W. T.
Smoot, L. D.
Sohier, Wm. D.
Sorgen, J. W.
Southgate, James H.
Southern Appalachian Good Roads Association
Southern Clay Manufacturing Co.
Southwestern States Portland Cement Company
Spalding, A. G.
Spaulding, E. H.
Speare, Lewis R.
Speed & Company, J. B.
Speer, Joseph McK.
Spencer, H. B.
Spencer, Herbert
Spencer, W. B.
Spetman, E. E.
Spilman, B. D.
Sprague, Albert A.
Sprague, A. A., 2d
Sproul, William C.
Sprunt, James
Stagg, J. E.
Stahlman, Maj. E. B.
Standard Lime & Stone Company
Standard Portland Cement Co.
Stanley, L. T.
Stapleton, L. L.
Staunton, Fred M.
Stearns, Irving A.
Steele, Charles
Stephenson, E. B.
Stephenson, Samuel
Stephenson, Mrs. Walter B.
Sterling, J. M.
Sterling, Robert B.
Stern, Ira G.
Stetson, Francis L.
Stevens, Rear Admiral T. H.
Stevens, Mrs. T. H.
Stevenson, A. E.
Stevenson, Wm. H.
Stewart, Jas. H.
Stewart, John W.
Stewart, Spencer J.
Stiles, F. L.
Stinchcomb, W. A.
Stockmann, C., Jr.
Stokely, J. T.
Stone, Charles A.
Stone, W. E.
Stone, W. G.
Stone, Wm. H.
Stoney, Samuel G.
Storrow, James J.
Stowell, Harley L.
Strahan, C. M.
Strickling, James H.
Stringham, Jos. S.
Strong, Frederick Steele
Stroh, Julius
Stroop, William
Strother, Jas. A.
Stuart, H. C.
Stuck, B. F.
Studebaker Brothers Mfg. Co.
Sucro, Wm. G.
Suggs, Sidney
Sullivan, J. H.
Sumner, Eliot
Sunderland L. T.
Sutherland Howard
Swan, Charles F.
Sweeney, Chas. F.
Sweeney, E. R.
Swett, Bertram L.
Swift, Wm. H.
Swineford & Son, Howard

Taber, Mary
Taft, Robert V.
Talbert, Charles M.

Talbot, K. H.
Tallman, W. H.
Taylor, Jesse
Taylor, John
Taylor, W. W.
Taylor, William C.
Tejan, Frank
Tennessee Metal Culvert Co.
Tenney, George O.
Terhune, Mrs. M. Virginia
Terrell, Robert C.
Terry, Dr. M. O.
Tetrick, W. Guy
Texarkana Pipe Company
Thacher, Mrs. John B.
Thacher, John S.
Thatcher, Charles W.
Thayer, G. T.
Thiel, F. J. F.
Thoma, W. C.
Thomas, Knox T.
Thompson, H. W.
Thompson, J. B.
Thompson, M. Roy
Thompson, Philip L.
Thompson, Mrs. Wm. R.
Thompson, Wm. R.
Thompson, W. S.
Thompson, W. T.
Thurston, R. C. Ballard
Tidewater Portland Cement Co.
Tierney, Lawrence E.
Tipper, Harry
Tobin, J. J.
Todd, Edward N.
Teepleman, F. C.
Tompkins, Robert F.
Tory, James C.
Towne, Burton A.
Townsend, Lawrence
Townsend, Samuel
Trainer, J. Ed.
Trayer, W. H.
Trevor, John M.
Trexler, Harry C.
Trocon, A. A.
Troy, Peter H.
Troy Wagon Works Company
Trussed Concrete Steel Company
Trussell, C. G.
Tumlin, E. D.
Tupelo Engineering Company
Turman, S. B.
Twitchell. Oscar
Tyler, B. A.
Tyler. Nat, Jr.

Uihlein, Edgar J.
Ulman, Jacob A.
United Brick Company, The
United Construction Company
Universal Road Machinery Co.

Valentine, Frederick S.
Vanderbilt, W. K., Jr.
Van Doorn, J. C.
Vander Horst, Elias
Vanderlip, Frank A.
Van Dusen-Roys & Company
Van Horne, Perry
van Westrum, G. S.
Varner, H. B.
Vaughan, J. W.
Vickers, R. E.
Vinson, Z. Taylor
von Schlegell, A.

Wade, J. W.
Wade, S. I.
Waernicke, H. E.
Walker Construction Company, James
Wallace, Edwin C.
Walter, H.
Walters, A. L.
Ward, W. H.
Warden, Henry
Wardwell, Allen
Waring-Underwood Company
Warner, John Elliott
Warren, George C.
Warren, J. Collins
Warren, Ralph L.
Washington, Joseph E.
Watson, C. W.
Watson, E. J.
Watson, James E.
Watts, George W.
Waugh, Douglas
Waugh, W. D.
Weatherwax, H. B.
Weaver, I. U.
Weaver, R. S.
Webb, J. F.
Webb City & Carterville Foundry and Machinery Company
Webber, Richard H.
Webber, W. C.
Weeks, Harry
Weller, O. E.
Welsh, Charles N.
Wendell, Barrett
Wents, Frank

Wertheim, L. J.
West, Wylie
Western States Portland Cement Company
Weston, Joseph
Wheeler, Samuel H.
Whitcraft, Arthur
White, Clark
White, Chas. D.
White, E. T.
White. George
White, I. C.
White, J. B.
White, M. Z.
White, Mrs. Stanford
White, Thos. P.
Whitehead & Hoag Company
Whitelaw, W. M.
Whitham, C. G.
Whitin, E. Stagg
Whitis, Thos. P.
Whitmarsh, Thos. C.
Whitney, E. O.
Whitney, George L.
Whitney, W. B.
Whittaker, A. B.
Wiard Plow Company
Wickersham, T. A.
Wilbur, James B.
Wilcox, F. P.
Wilcox, Walter D.
Wiley, Wm. H.
Wilkinson, O. Jennings
Willets, Howard
Williams, A. Dennis
Williams, Mrs. Davis T.
Williams, Frank M.
Williams, J. Farrand
Williams, Herbert L.
Williams, James T.
Williams, L. Judson
Williams, T. C., Jr.
Williamson, W. W.
Willits Brothers
Wilson, Blair P.
Wilson. Hugh M.
Wilson, James
Wilson, John
Wilson, J. Russell
Wilson, P. H.
Wilson, P. St. Julien
Wilson, W. E.
Wilson, William G.
Wilson, W. R.
Winchell, Benjamin La F.
Winchester & King
Winkler, C. F.
Winn Construction Company, E. L.
Winn, W. Tom
Winslow, D. H.
Winston, W. O.
Wintersmith, J. M.
Wise, George
Witbeck, Albert T.
Witherbee, Frank S.
Withers, J. P.
Wittenberg, Lester
Wittenburg, A. R.
Woddrop, L. H.
Wonders, James G.
Wood, George
Wood, Henry M.
Wood, Maj-Gen. Leonard
Woodbridge, C. E.
Woodruff, Harlan
Woods, Geo. W.
Woodward, George
Woodward, J. A.
Woodyard, Burdette
Woolley, Geo. H.
Worcester, Wm. C.
Work, George E.
Worrell, Mrs. Elisabeth P. S.
Wright, A. W.
Wright, Chas. A. L.
Wright, W. N.

Yeatman, Pope
Yoakum, B. F.
Young, Hugh H.
Young, M. R.

Zeese. Harry L.